

SONY®

SERVICE MANUAL
S E G

AUDIO MULTI-CHANNEL RECORDER

PCM-3324



SP01240

DIGITAL Professional
OPERATION AND MAINTENANCE MANUAL
Volume1 3rd Edition (Revised 3)
Serial No. 10301 and Higher

Before operating the unit, please read this manual thoroughly and retain it for future reference.

OWNER'S RECORD

The model and serial numbers are located on the rear of the unit. Record the serial number in the space provided below. Refer to them whenever you call upon an authorized Sony representative regarding this product.

Model No. PCM-3324 Serial No.

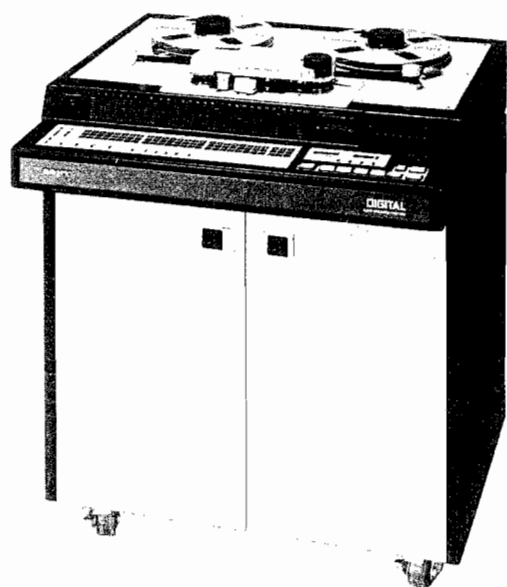
WARNING

This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instructions manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

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SECTION 1

OPERATION

1-1. PRINCIPAL FEATURES AND FUNCTIONS

1-1-1. Main Features

- **Compact size**
830 (W) x 1002 (H) x 740 (D) mm
- **Long recording, low tape consumption**
By adopting the fast version channel coding "HDM-1" of a format "DASH" (DIGITAL AUDIO STATIONARY HEAD), continuous one-hour recording and playback become possible on 24 digital channels using 1/2 inch wide tape on 14 inch reels (D-1/2-2920).
- **Compatibility with analog multi-track recorders**
Since the A/D and D/A converters are mounted in the input and output sections, this device can be connected to a conventional analog console without modification.
- **Compatibility with analog multi-track recorders in operation**
By adopting a "manual" editing and by the use of internal cross-fade, more accurate "manual" editing can be carried out, or point erase and punch in/out, like those available on conventional analog recorders, are possible. Manual cueing is possible using the 2 channel analog track on the tape edge. The recorded sound can be played back for monitoring while recording.
- **Multi Function Capability**
The following basic functions are incorporated: Channel grouping, Setup Memory (to memorize the function mode and the channel assignment state), Auto Locate, Shuttle, Punch in/out editing, REC REHEARSE and Auto Punch. The functions such as SYNCHRONIZE, etc. can be further extended by connecting a remote control unit to external devices.
- **Easy threading**
Virtually straight-line loading and easy tape threading by means of a sliding tension roller.
- **All DC motors (high performance, high efficiency and long life).**
DC brushless motors are used for take-up reel, supply reel, capstan and ventilation motors so as to obtain high performance, high efficiency and long life.
- **±12.5% pitch control**
Variable master clock
- **Front access**
Control from the front is possible.
- **Comprehensive control by incorporating a CPU and intelligent editing functions**
A CPU is used for all system control systems, functions are improved, and unit editing in the CTL unit and edit rehearsal become possible.
By using remote terminals (REMOTE-1, REMOTE-2, REMOTE-3), external devices can be easily connected. In addition, functions such as running adjustment, editing, full remote, etc. can be extended.
- **Tracking servo amplifier**
The heat loss in the motor drive amplifier is decreased by controlling the output voltage of a switching regulator for the motor power supply.
- **Switching regulators**
To make the machine compact, switching regulators are adopted for all power supplies.
- **Modular construction**
The digital and analog units are of rack construction. The power supplies and the servo amplifiers are of unit construction.
- **Digital I/O**
A DIGITAL I/O terminal is incorporated to exchange signals with other equipment within the digital domain. Dubbing is possible with no degradation of the original sound quality.
- **Sampling rate can be changed (44.1 kHz and 48 kHz)**
- **Emphasis automatic changeover during PB (Each channel is independent)**
- **Cross-fade function**
Cross-fade in the digital domain during splice editing, punching in/out, etc., guarantees smooth editing.
- **High reliability**
Format "DASH" (DIGITAL AUDIO STATIONARY HEAD) ensures more reliable signal error correction and withstands rough operation under severe conditions, just like analog models.

1-1-2. Functions and Configuration

- Easy threading
- All brushless motors
- Modular construction
- Front access
- System control CPU
- Switching regulators throughout
- Spill-proof flat-panel keys
- Shuttle function
- Pitch control and half tone/% display
- Auto locator can be used as timer
- Simultaneous recording/playback function
- Cueing function using 2-CH analog tracking
- EDIT STOP function
- Channel grouping function, setup memory function
- Point erase (REC mute) function
- Punch in/out function
- Rehearsal function (with REC rehearsal key)
- Automatic punch in/out function
- Mismatch alarm function (Format, sampling rate and emphasis)
- Emphasis function (based on EIAJ) ON/OFF during recording (all channels independent), automatic changeover during PB
- Servo unlock alarm
- Dropout alarm
- Sampling rate changeover (48 KHz, 44.1 kHz and automatic changeover during PB)
- Sync clock (INT/EXT/AUTO) changeover
- Timer mode (RELATIVE/ABSOLUTE) changeover
- INPUT SELECTOR (All analog/all digital/individual)
- Analog digital I/O (Serial digital I/O)
- Monitor mode (AUTO INPUT/MANUAL) changeover
- Balanced Transformerless Analog I/O

1-2. PRINCIPAL SPECIFICATIONS

GENERAL

Dimensions (mm)	830 (W) x 1002 (H) x 740 (D)	
Weight	220 kg	
Power supply	AC100 ~ 120V, 50/60 Hz (J) AC100 ~ 120V, 50/60 Hz (U/C) AC220 ~ 240V, 50/60 Hz (AEP)	
Power consumption	2 kVA, 1.8 kW (at peak time)	
Working temperature	10° ~ 35°C Performance guaranteed 0° ~ 35°C Functions guaranteed	
Working relative humidity	30 ~ 70% Performance guaranteed 25 ~ 80% Functions guaranteed	
Storage temperature	-20° ~ +60°C	
Storage humidity	25 ~ 90%	
Recording format	DASH-F (DIGITAL AUDIO STATIONARY HEAD FAST VERSION)	1 Tr/CH
Channel coding	HDM-1	
No. of digital audio channels	24CH	
Quantization	16-bit linear (each channel)	
Error-control	Cross interleave code	
Recording time	60 min (fs = 48 kHz) 65 min (fs = 44.1 kHz)	} Using 14 inch reel
Tape speed	76.20 cm/sec (fs = 48 kHz) 70.01 cm/sec (fs = 44.1 kHz)	
Tape speed adjustable range	±12.5%	
Fast-forwarding time	4 min. 40 sec.	14 inch reel
Tape used	1/2 inch wide Sony D-1/2-2920 (14 inch reel) D-1/2-1460 (10.5 inch reel)	
Reels used	14 ~ 7 inch	
Heads	Digital REC x2 Digital PB x1 Analog R/P x1 Analog E x1	
Recording tracks	D1 ~ D24, CTL A1 ~ A2, Time Code	

INPUT/OUTPUT

Digital audio input x24	Specified input	+4 dBm	Gain adjustable in the range $\begin{matrix} +10 \\ -6 \end{matrix}$ dB
	Max. input	+24 dBm	
	Impedance	10 k Ω	
	Connector	XLR-32x24	
Digital audio output x24	Specified output	+4 dBm (–2 dBm)	When load is 600 Ω
	Max. output	+24 dBm (+18 dBm)	When () is at unbalanced
	Impedance	Less than 100 Ω	Balanced (Selectable into unbalanced)
	Connector	XLR-31x24	or XLR-32x24
Analog audio input x2	Specified input	+4 dBm	Gain adjustable in the range ± 6 dB
	Max. input	+12 dBm	
	Impedance	10 k Ω	
	Connector	XLR-32x2	
Analog audio output x2	Specified output	+4 dBm	When load is 600 Ω
	Max. output	+12 dBm	
	Impedance	Less than 100 Ω	
	Connector	XLR-31x2	or XLR-32x2
Digital I/O each 24	Format	Serial	fs = 48 kHz fs = 44.1 kHz
	Bit-rate	1.53Mbit/s 1.41Mbit/s	
	Electrical characteristics	RS-422	
	Connector input	D-sub 50P x1	
Word sync input x2	Connector output	D-sub 50S x1	Balanced 1 connector per 24-channels 1 connector per 24-channels
	Level	TTL	Unbalanced 75 Ω with ON/OFF with through-out
	Impedance	75 Ω	
	Connector	BNC x2	
Word sync output x2	Level	TTL	Unbalanced 75 Ω with ON/OFF with through-out
	Impedance	75 Ω	
	Connector	BNC x2	
Sector sync input x2	Level	TTL	Unbalanced 75 Ω with ON/OFF with through-out
	Impedance	75 Ω	
	Connector	BNC x2	
Sector sync output x2	Level	TTL	The composite sync requires an optional board (under preparation) for TV SYNC signal. Unbalanced.
	Impedance	75 Ω	
	Connector	BNC x2	
Composite sync input x 1	Level	0.3 Vp-p	The composite sync requires an optional board (under preparation) for TV SYNC signal. Unbalanced.
	Impedance	75 Ω	
	Connector	BNC x1	
REMOTE 1 input x 1	Format	SRIF-1	Balanced
	Level	TTL	
	Impedance	200 Ω	
	Connector	D-sub 37S x 1	
REMOTE 2 input x 1	Format	SRIF-2	Balanced
	Electrical characteristic	RS-422	
	Impedance		
	Connector	AMP 104P	

REMOTE 3 input x 1	Format	SRIF-3	
	Electrical characteristics	RS-422	
	Impedance		Balanced
	Connector	D-sub 50S x 1	
Time Code input x 1	Level	0.5 ~ 10 Vp-p	
	Impedance	10k Ω	Balanced
	Connector	XLR-32 x 1 or XLR-31 x 1	
Time Code output x 1	Level	0 ~ 1.5 dBm	
	Impedance	Less than 100 Ω	Balanced
	Connector	XLR-31 x 1 or XLR-32 x 1	
SECTOR ADDRESS one per I/O	Level	TTL	
	Impedance	75 Ω	
	Connector	BNC x 2	
EXTERNAL speed control input x 1	Level	$\pm 10V$	
	Impedance	10 k Ω	Balanced
	Connector	XLR-32 x 1	
EXTERNAL phase control input x 1	Level	+10V -10V	
	Impedance	10 k Ω	Balanced
	Connector	XLR-32 x 1	
Ground x3	military type terminal		

Refer to the tape drive system in servo system characteristics.

DIGITAL AUDIO SYSTEM CHARACTERISTICS

Frequency range	20 Hz ~ 20 kHz	+0.5 -1.0 dB
Signal-to-noise ratio	More than 90 dB (1 kHz, EMPHASIS ON)	
Overall distortion	Less than 0.05%	20 Hz ~ 20 kHz specified level
Inter-Channel cross-talk	More than 80 dB	20 Hz ~ 20 kHz
Emphasis	Based on EIAJ	ON/OFF possible in each channel during REC
Level indication	16-segment LED	
Pitch control	Variable range Variable rate	87.5 ~ 112.5% 0.78%/sec %/HALF TONE indication changeover possible
Sampling frequency	44.1 kHz, 48 kHz $\pm$ 50 PPM	Changeover possible during REC and automatic changeover during PB
Muting	No abnormal sound is produced by an error	
Signal processing system approx delay time	Average delay time during playback 224 Blocks Delay time during recording 196 Blocks	For the unit of blocks, refer to the "Tape and Signal Format" in 1-11.

RF system characteristics

Cross-fade time					
	Electronic editing	{	fs	44.1 kHz	48 kHz
			Min	1.45ms	1.33ms
			Max	0.372s	0.341s
	Splice editing		Fixed	5.66ms	5.20ms

Variable 16 steps between min and max

ANALOG SYSTEM CHARACTERISTICS

Frequency range	100 Hz ~ 20 kHz $\pm$ 6 dB
Signal-to-noise ratio	More than 35 dB
Overall distortion	Less than 4%
Wow and Flutter	Less than 0.1%
Level Indication	8-segment LED peak level
Bias frequency	200 kHz
Playback time constant	$T_1 = \infty$ $T_2 = 17.5\mu\text{sec}$

SERVO SYSTEM CHARACTERISTICS (I)

Capstan system

Lock-in time	Less than 0.5sec	At start
Recovery time	Less than 0.5sec	

Tape Drive system

Tape speed	76.20 cm/s (fs = 48 kHz) } 70.01 cm/s (fs = 44.1 kHz) }	When recording
Wow and Flutter	0.1% rms (un weighted)	
FWD rise	Less than 0.36sec for 0	
FF/REW max. speed	14.0 m/s, 1.52 m/s during SLOW WIND	
Shuttle, speed adjustable range	0, $\pm$ 7.6 cm/s $\sim$ 3.8 m/s	
External speed control input sensitivity	140 cm/s/V	
External phase control input sensitivity	Play speed $\pm$ 5%/V	

Reel system

Max. rotational rate	1300rpm
Reeling time	14 inch: 4 min 45sec 10.5 inch: 2 min 45sec

Timer roller accuracy	$\pm$ 3.6sec, 14 inch Reel
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Locator system

Locate accuracy	Timer roller $\pm$ 3.6sec 14 inch Reel CTL address $\pm$ 50msec 14 inch Reel	(However, when it is possible to read the CTL address on the tape)
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OTHER CHARACTERISTICS

Head Gap Accuracy

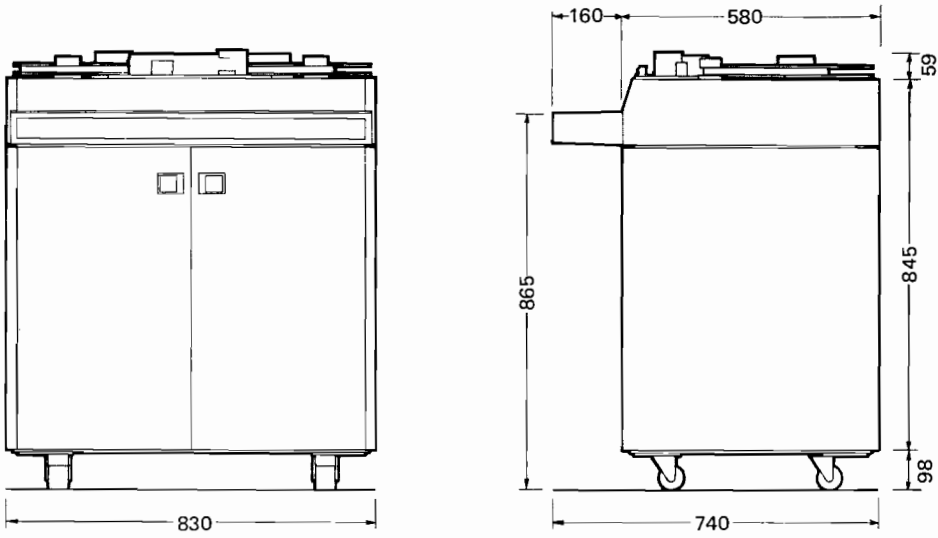
Digital P.B Head and Digital SYNC REC Head	420 Blocks $\pm$ 0.3 Blocks	Machine accuracy
Digital P.B Head and Digital ADVANCE REC Head	100 Blocks $\pm$ 1 Block	Machine accuracy
Digital P.B Head and Analog R.P Head	224 Blocks $\pm$ 0.3 Blocks	Not specifically adjusted

Editing accuracy	1 sector	1.00 msec at fs = 48 kHz 1.09 msec at fs = 44.1 kHz
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Overall Transmission Distance

Digital INPUT/OUTPUT	Less than 75m	For the unit of sectors, refer to the "Tape and Signal Format" in 1-11.
Remote INPUT	Less than 20m	
SYNC system	Less than 75m	

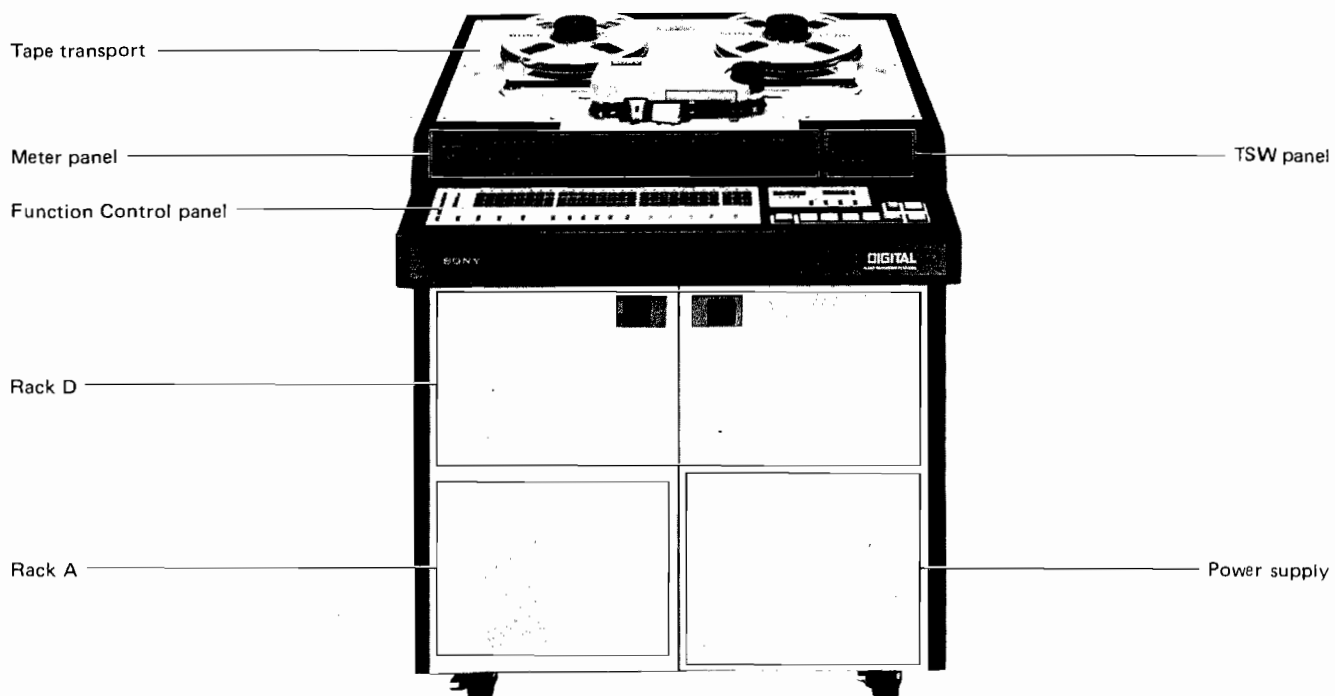
DIMENSIONS



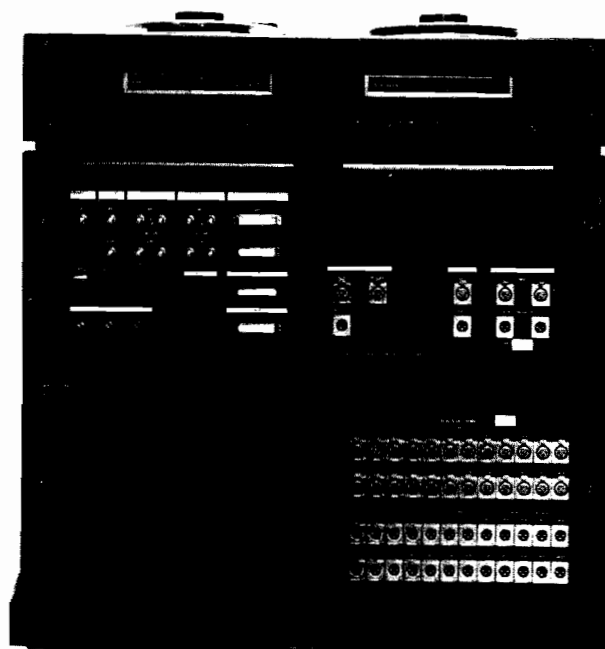
Unit: mm

1-4. DESCRIPTION OF FUNCTION AND CONTROLS

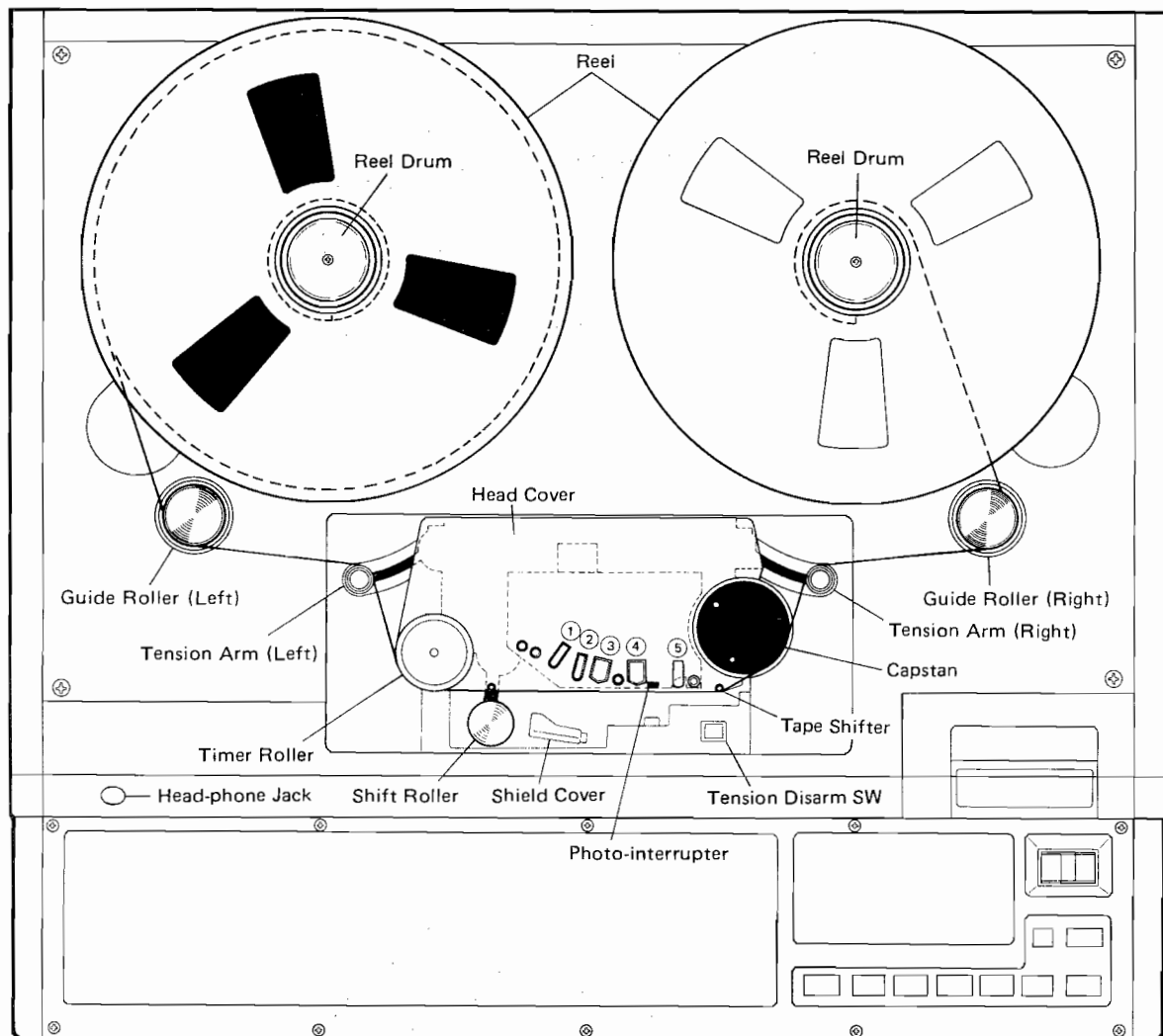
1-4-1. External Appearance



Rear panel (connectors)

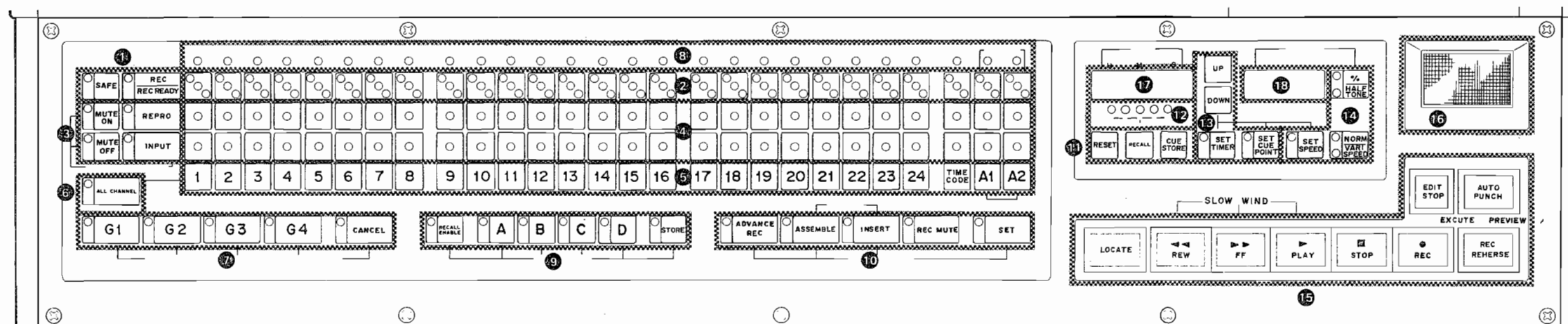


1-4-2. Tape-transport Mechanism



- ① Digital REC Head (advance REC head)
- ② Digital P·B Head
- ③ Analog Erase Head
- ④ Analog REC/P·B Head
- ⑤ Digital REC Head (sync REC head)

1-4-3. Function Control Panel

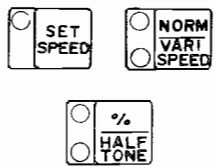
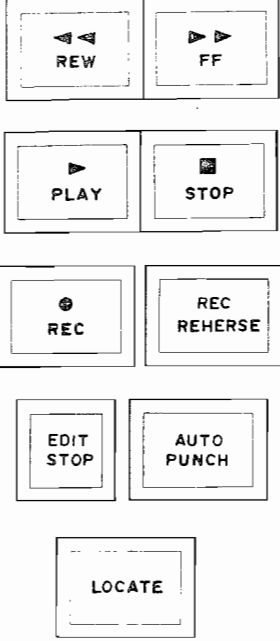


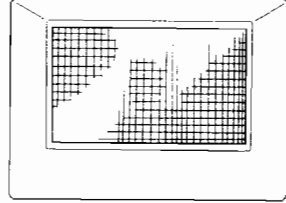
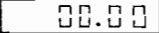
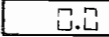
INDEX	DISPLAY	FUNCTION
1		This function selects the Recording Inhibited CH and Recording Ready CH. SAFE While the LED (Green) is lighting following depression of this MODE key, if the CH key required is depressed, the CH assumes the SAFE (Recording inhibited) state. REC REC READY While the LED (Orange) is lighting following depression of this MODE key, if the CH key required is depressed, the CH assumes the REC READY (Recording ready) state. Depression of MODE key causes the LED for each MODE key to light for 5 seconds as the effective period for mode designation. When the CH key is depressed during this period, the mode for that CH is decided. The effective period is extended by another 5 seconds from the time of that CH key. Also, depression of the MODE key during the effective period causes the Mode Indicator LED to go OFF.
2		REC, REC READY, SAFE MODE INDICATOR Green lamp ON SAFE state Orange lamp ON REC READY state Red & Orange lamps ON . . REC state (During PLAY & REC only) (However, A1 and A2 CHs also light up during PLAY). * When the power is switched on, all channels assume the SAFE state automatically (Green lamps light).

INDEX	DISPLAY	FUNCTION
3		This function selects the monitor mode for each channel. REPRO Monitors reproduced signals. While the LED (Orange) is lighting following depression of this MODE key, if the CH key required is depressed, the CH assumes the REPRO mode. INPUT Monitors input signals. While the LED (Orange) is lighting following depression of this MODE key, if the CH key required is depressed, the CH assumes the INPUT mode. MUTE ON While the LED (Orange) is lighting following depression of this MODE key, if the CH key required is depressed, the monitor signal of the CH is muted. (Both REPRO and INPUT are muted.) MUTE OFF While the LED (Orange) is lighting following depression of this MODE key, if the CH key for which the MUTE state is required to be cancelled is depressed, the MUTE state is cancelled.
4		MUTE ON & REPRO MODE INDICATOR MUTE OFF & INPUT MODE INDICATOR REPRO MODE { } INPUT MODE { } MUTE ON { } ----- Lamp is lit.
5		Keys for selecting channels When this key is matrixed with keys 1 and 3, the state of each channel is determined.

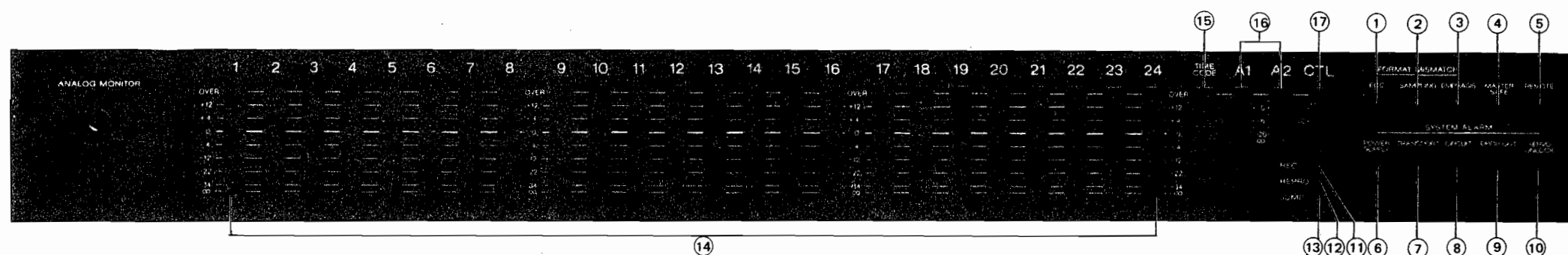
INDEX	DISPLAY	FUNCTION
⑤		By depressing this key, the same result as obtained by depressing all CH keys ① through ②④ can be obtained, and it can be operated as the CH keys in ⑤ above.
⑦	 GROUPING MEMORY	Up to 4 combinations of CH keys ① to ②④ can be grouped. G-n Depressing this key has the same result as depressing all grouped CHANNEL keys at the same time. Like the ALL CHANNEL key, it can be operated as the CH keys in ⑤. The grouping procedure is as follows: When the G-n key is depressed while depressing the CHANNEL keys required to be grouped, the CHANNEL INDICATOR will light showing that grouping of the keys is completed. To delete a certain channel from the group, depress the required CH key from those channels for which CHANNEL SELECT LED is lit while depressing G-n, and that CH becomes independent of the group. At power switch-on, the grouped state prevailing before power OFF will either be memorized or be initialized without being memorized, according to the setting of the DIP SW on the MCPU board. (Refer to 1-5-3. Switches on the MCPU Board.)
⑧	 CHANNEL INDICATOR	When CH key ⑤, ⑥ or ⑦ (①~②④), TIME CODE, ALL CHANNEL, G-n is depressed before depression of MODE key ① or ③, the INDICATOR corresponding to each of the CH keys will light. Then, when the MODE keys ① and ③ are depressed, it is possible to assign the mode corresponding to the channel in which the INDICATOR lights. (The assigned operation during the effective period is the same as that in ⑩.)
⑨	 SET UP MEMORY	These are the Keys causing the individual state (SAFE, REC READY, MONITOR) of the 24 channels to be memorized or causing the memorized state to be called out and reproduced. When STORE is depressed, the INDICATOR (orange) lights. Then, by depressing A, the channel state displayed can be memorized, and the STORE INDICATOR goes OFF. (With the 4 keys, A through D, 4 states can be memorized.) When RECALL ENABLE is depressed, the INDICATOR (orange) lights. Then, by depressing one of the keys A through D, the memorized state can be recalled on the control panel. If any of the keys A through D is depressed, the REC MONITOR state can be changed over instantaneously. Further, if RECALL ENABLE is depressed, the INDICATOR goes OFF. At power switch-on, the state prevailing before the power OFF is either memorized or is initialized, according to the setting of the DIP SW on the MCPU board. (Refer to 1-5-3. Switches on the MCPU Board.)

INDEX	DISPLAY	FUNCTION
⑩	 When the power is turned on, the ADVANCE, ASSEMBLE and INSERT REC modes are sequentially switched over in display. Depress the SET key simultaneously with any of the REC MODE keys to select the required mode. (If not selected, the REC mode is not established).	These keys are designed to switch over the recording mode. By depressing SET simultaneously with any of the 4 REC MODE keys, the mode required can be selected. REC MUTE can be cancelled by depressing only the REC MUTE key once again. ADVANCE REC Simultaneous monitoring and recording All tracks are recordable. ASSEMBLE REC Synchronous recording All tracks are recordable. INSERT Synchronous recording Tracks other than CTL track are recordable.
⑪		CUE STORE While the tape is running, the present tape time is shown in seconds on the Tape Timer Display. By depressing this key, the time of pressing can be memorized at the next place where the Cue Point Display 1 ~ 4 is lit. Releasing this key advances the CUE POINT INDICATOR by 1 point so as to reach the memorized CUE point. (The CUE POINT 4 is followed by CUE POINT 1.) RECALL This key is designed to recall the time memorized by CUE STORE and zero time. When this key is depressed while the present tape time is displayed, the Cue Point Indicator advances by 1 point, and the time memorized in the place where Cue Point indicating lamp is lit is displayed on the Timer Display. (The CUE POINT 4 is followed by ϕ). When the key is released, the indication will return to the present tape time. RESET Enables resetting of tape time to Zero.
⑫	 Red 0-1-2-3-4	CUE POINT Indicator
⑬		SET TIMER This key is used for setting the time on Tape Timer Display. When this key is depressed, the orange lamp lights and the present tape time is displayed. The tape time can be set by depressing the UP and DOWN keys. If they are further depressed, the orange lamp goes OFF. When this key is kept depressed, tape time increases continuously from the present time. When the DOWN key is depressed while this key is depressed the tape time decreases continuously from the present time. When the UP key is depressed while this key is depressed, the decreased speed becomes faster. UP DOWN

INDEX	DISPLAY	FUNCTION
		SET CUE POINT This key is used for setting the time of CUE POINT. When this key is depressed, the orange lamp lights, and the time set to the number of the LED lamp which is lit on the Cue Point Display is displayed on the Tape Time Display. The time can be changed by depressing the UP or DOWN key. If it is further depressed, the orange lamp goes OFF.
14		SET SPEED The orange lamp lights and the tape speed pitch can be changed, by depressing this key. There are two units for indication, % and HALF TONE. They can be changed over by the %/HALF TONE key. The indication can be continuously changed in the range $\pm 12.5\%$ by depressing the UP or DOWN key when the SET SPEED orange lamp is lighting. After setting to the required indication pitch, if VARI SPEED mode is set by depressing the NORM/VARI SPEED key, the tape speed pitch can be changed to the set speed. Then, the INDICATOR of NORM/VARI SPEED will flash to indicate that the tape speed pitch is changing gradually to the set speed. If it reaches fully the set speed, the INDICATOR will light continuously. Changing over of VARI SPEED mode to NORM mode is also the same as the above operation for indication. If the SET SPEED key is further depressed, the orange lamp goes OFF.
15		These keys are designed to control the tape run. REW Rewind Depressing the REW and FF at the same time as PLAY key enables them to be two times normal speed. FF Fast Forward PLAY Fixed-Speed Running (Reproduction) STOP Stop and Shuttle Modes PLAY + REC Record The recording PUNCH IN, PUNCH OUT points are memorized when REC is started or canceled. PLAY + REC REHEARSE Record rehearsal The record rehearsal PUNCH IN, PUNCH OUT points are memorized when REC REHEARSAL is started or canceled. EDIT STOP During PLAY, when this key is depressed, the tape post-rolls for 5 seconds from time of depression, then the tape pre-rolls and stops.

INDEX	DISPLAY	FUNCTION
		AUTO PUNCH + REC REHEARSE Preview is available for Punch-in and Punch-out points memorized by PLAY + REC REHEARSE PLAY + REC AUTO PUNCH + REC AUTO PUNCH IN/OUT is executed for the punch-in and Punch-out points memorized by PLAY + REC REHEARSE PLAY + REC LOCATE When LOCATE is depressed, the tape is returned and stopped to the Cue Point indicated in 12. The tape starts PLAY after it has returned to the Cue Point indicated in 12 either by LOCATE while PLAY is depressed or by PLAY while LOCATE is depressed. At power switch-on, the STOP button flashes.
16		STOP In the STOP state, the run direction and speed of the tape can be controlled by the shuttle lever. The tape may now be cued by monitoring the playback sound on the analog track.
17		TAPE TIMER DISPLAY
18		TAPE SPEED DISPLAY

1-4-4. Name and Function of Meter Panel LEDs



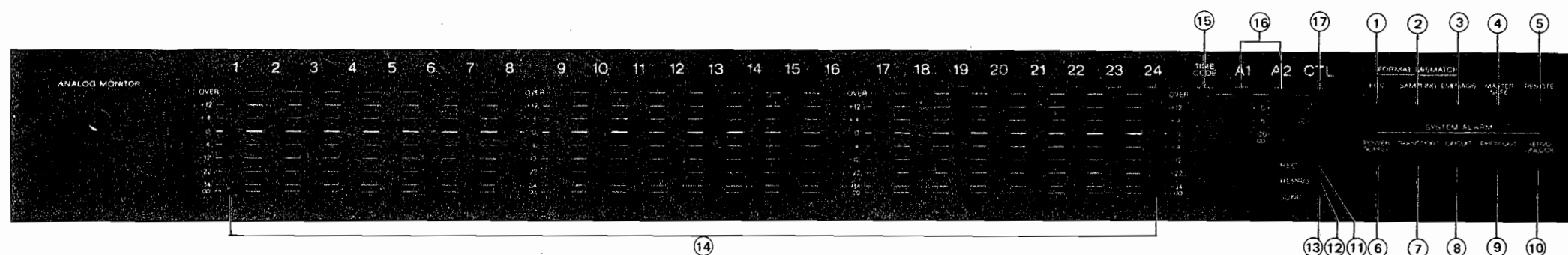
Format Mismatch

- ① **ECC** : This lamp lights when the replay signal is another recording format.
- ② **SAMPLING** : This lamp lights when sampling frequency of the replay signal is different from that of the unit being used.
- ③ **EMPHASIS** : This lamp lights when the emphasis on /off data of the replay signal is different from that of the REC signal set on the TSW panel in the same channel.
- ④ **MASTER SAFE** : This lamp lights when the MASTER SAFE SW is ON.
- ⑤ **REMOTE** : This lamp lights when the MASTER SAFE SW is ON.
This lamp lights when the SYSTEM CONTROL SW is set to REMOTE. In this case, control by the unit is not possible.

System Alarm

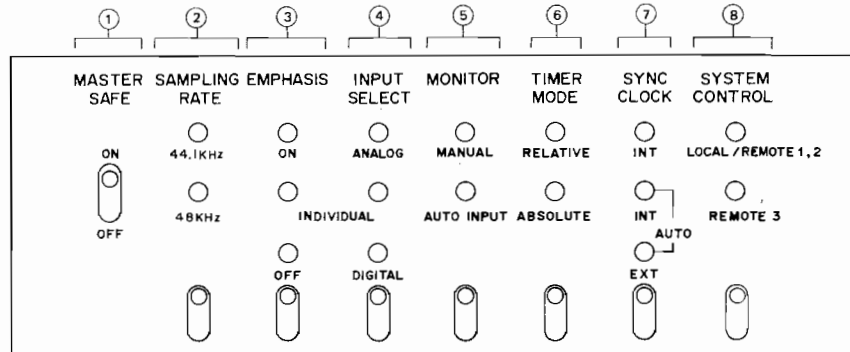
- ⑥ **POWER SUPPLY** : Lights when any abnormality occurs in the power circuit.
- ⑦ **FAN** : Lights when any abnormality occurs in the ventilation fan motor. The lighting status is held until the MCPU is reset.
- ⑧ **CIRCUIT** : Lights when any abnormality occurs in the REC signal system.
- ⑨ **DROPOUT** : Lights when DROPOUT in the CTL track occurs with an unusually high frequency.
- ⑩ **SERVO UNLOCK** : Lights when the servo lock is unlocked.

- ⑪ REC: Remains lit while CTL is sound-recording.
- ⑫ REPRO: Remains lit while CTL is in playback mode.
- ⑬ JUMP: Lights when the CTL address has jumped.
- ⑭ Level Meter (Digital Channel)
- ⑮ Level Meter for Time Code: In case of the appropriate level, the LED (red) goes off.
- ⑯ Level Meter (Analog Channel)
- ⑰ Level Meter for CTL: In case of the appropriate level, the LED (red) goes off.



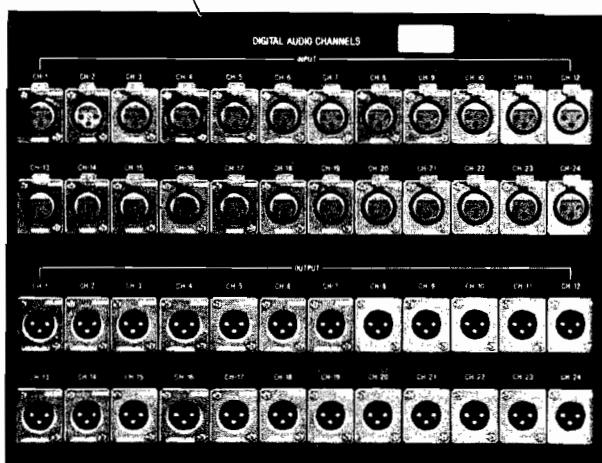
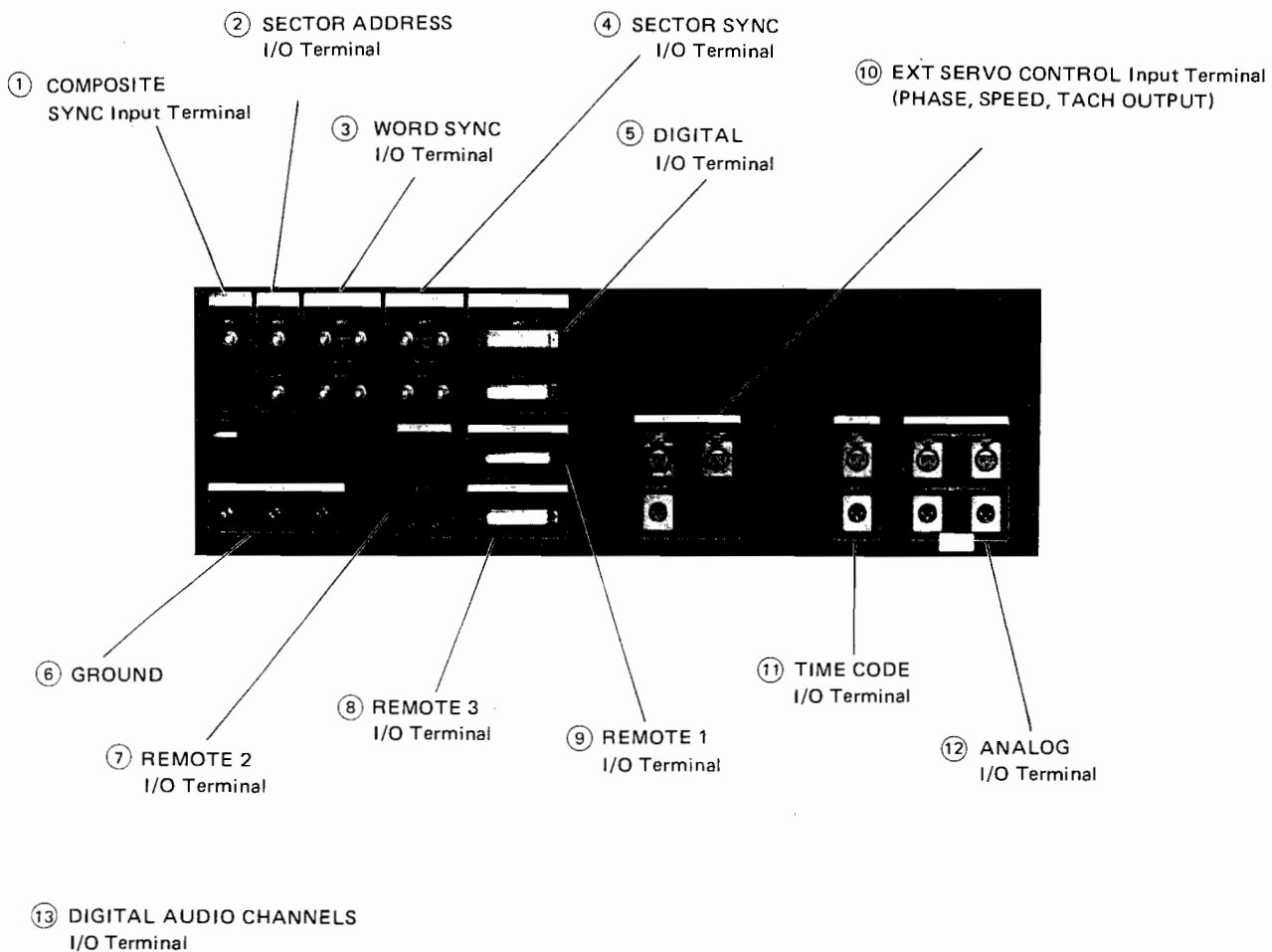
- ⑪ REC: Remains lit while CTL is sound-recording.
- ⑫ REPRO: Remains lit while CTL is in playback mode.
- ⑬ JUMP: Lights when the CTL address has jumped.
- ⑭ Level Meter (Digital Channel)
- ⑮ Level Meter for Time Code: In case of the appropriate level, the LED (red) goes off.
- ⑯ Level Meter (Analog Channel)
- ⑰ Level Meter for CTL: In case of the appropriate level, the LED (red) goes off.

1-4-5. Names and Functions of TSW Panel



- | | | | | | | | |
|---|---|--|--|--|---|---|--|
| <p>① MASTER SAFE</p> <p>ON : Inhibits sound recording for all channels.</p> <p>OFF : Allows recording.</p> | <p>② SAMPLING RATE</p> <p>Changes the sampling frequency. When the switch SW4 on the MCU board in 1-5-3 is set to the BATTERY BACKUP mode, the position prior to the power ON is stored.</p> <p>44.1KHz</p> <p>48KHz</p> | <p>③ EMPHASIS</p> <p>A switch to provide emphasis during recording.</p> <p>ON : EMPHASIS ON for all channels</p> <p>INDIVIDUAL : ON/OFF is selectable for each channel.</p> <p>OFF : EMPHASIS OFF for all channels</p> <p>When the switch SW4 on the MCU board in 1-5-3 is set to the BATTERY BACKUP mode, the position prior to the power ON is stored.</p> | <p>④ INPUT SELECT</p> <p>This function selects analog or digital input.</p> <p>ANALOG : Selects analog input for all channels.</p> <p>INDIVIDUAL : Separate selection of analog/digital for each circuit board is available using the ANALOG/DIGITAL switch on the DIN board.</p> <p>DIGITAL : Selects digital input for all channels.</p> | <p>⑤ MONITOR AUTO INPUT</p> <p>For the DIGITAL AUDIO and ANALOG channels set to REC READY mode.</p> <p>For STOP, FF or REW, the MONITOR of the DIGITAL AUDIO channel assumes INPUT</p> | <p>⑥ TIMER MODE</p> <p>MANUAL : Monitor mode is selectable manually.</p> <p>RELATIVE : Detects TACH pulses at the Timer Roller and displays the time.</p> <p>ABSOLUTE : Reads the CTL recorded on the tape and displays the time.</p> | <p>⑦ SYNC CLOCK</p> <p>This switches over between external and internal sync.</p> <p>INT : The internal master clock is used as reference sync.</p> <p>AUTO : When sync is external:</p> <ul style="list-style-type: none"> • When no external sync is input INT lights. (The internal master clock is used automatically.) • When an external sync is input EXT lights. | <p>⑧ SYSTEM CONTROL</p> <p>This function switches over the control mode for the whole system between LOCAL, for which control is performed on the unit, and REMOTE for which control is performed by the remote controller.</p> <p>LOCAL/REMOTE 1, 2 : This mode is selected when control is required on the unit, REMOTE 1 and REMOTE.</p> <p>REMOTE 3 : This mode is selected when control is required on REMOTE 3.</p> |
|---|---|--|--|--|---|---|--|

1-4-6. Rear Panel (Connectors)

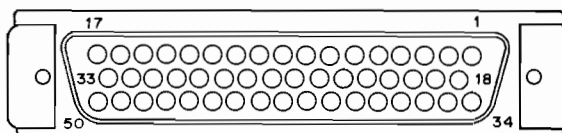


- ① **COMPOSITE SYNC Input Terminal**
Input terminal for TV sync signal. This is used to synchronize the master clock with the vertical sync signal.
- ② **SECTOR ADDRESS I/O Terminal**
This is used to hold the address data per 1 CTL unit (defined as 1 sector unit) recorded on the CTL track, to indicate the absolute time by remote control and editor or to decide the LOCATE point and the EDIT point.
- ③ **WORD SYNC I/O Terminal**
Input/output terminal to make the sampling frequency and phase the same as those of other devices. (The switch is a 75Ω terminated ON/OFF switch.)
- ④ **SECTOR SYNC I/O Terminal**
Input/output terminal to adjust not only the sampling frequencies between devices but also the CTL phases. (The switch has the same purpose as the WORD SYNC Terminator Switch.)

- ⑤ **DIGITAL I/O Terminal**
Input/output terminal to control the tape speed and phase of the servo system.
(This is used to be connected with the synchronizer.)
- ⑥ **GROUND**
- ⑦ **REMOTE 2 I/O Terminal**
- ⑧ **REMOTE 3 I/O Terminal**
- ⑨ **REMOTE 1 I/O Terminal**

- ⑩ **EXT SERVO CONTROL INPUT Terminal (PHASE, SPEED, TACH OUTPUT)**
Input terminal to control the tape speed and phase of the servo system.
- ⑪ **TIME CODE I/O Terminal**
- ⑫ **ANALOG I/O Terminal**
- ⑬ **DIGITAL AUDIO CHANNELS I/O Terminal**

— TOP VIEW —



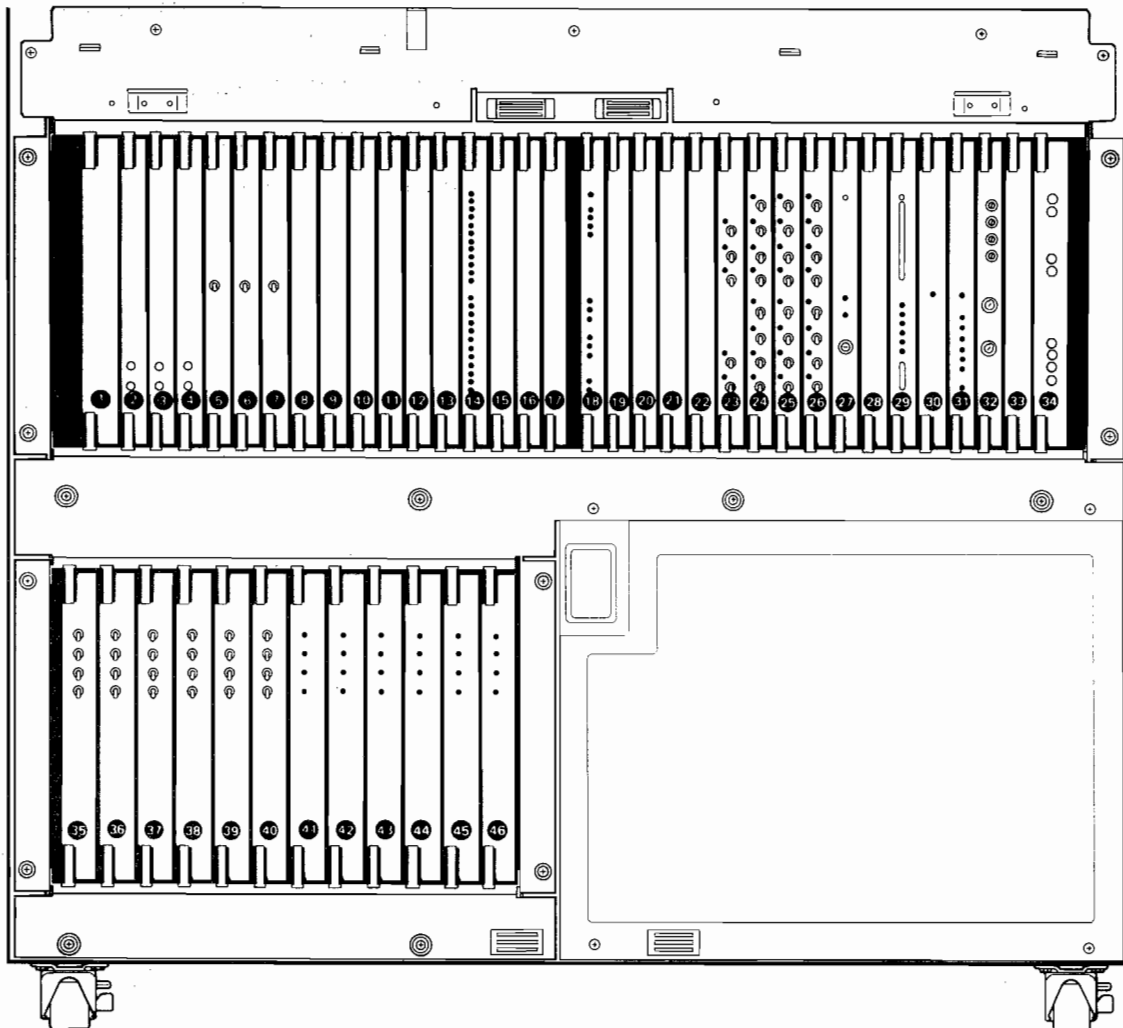
DIGITAL OUTPUT

PIN NO.	NAME	PIN NO.	NAME
1	CH-1 OUT -	2	CH-1 OUT +
3	CH-2 OUT -	4	CH-2 OUT +
5	CH-3 OUT -	6	CH-3 OUT +
7	CH-4 OUT -	8	CH-4 OUT +
9	CH-5 OUT -	10	CH-5 OUT +
11	CH-6 OUT -	12	CH-6 OUT +
13	CH-7 OUT -	14	CH-7 OUT +
15	CH-8 OUT -	16	CH-8 OUT +
17	CH-9 OUT -	18	CH-9 OUT +
19	CH-10 OUT -	20	CH-10 OUT +
21	CH-11 OUT -	22	CH-11 OUT +
23	CH-12 OUT -	24	CH-12 OUT +
25	CH-13 OUT -	26	CH-13 OUT +
27	CH-14 OUT -	28	CH-14 OUT +
29	CH-15 OUT -	30	CH-15 OUT +
31	CH-16 OUT -	32	CH-16 OUT +
33	CH-17 OUT -	34	CH-17 OUT +
35	CH-18 OUT -	36	CH-18 OUT +
37	CH-19 OUT -	38	CH-19 OUT +
39	CH-20 OUT -	40	CH-20 OUT +
41	CH-21 OUT -	42	CH-21 OUT +
43	CH-22 OUT -	44	CH-22 OUT +
45	CH-23 OUT -	46	CH-23 OUT +
47	CH-24 OUT -	48	CH-23 OUT +
49	N.C.	50	N.C.

DIGITAL INPUT

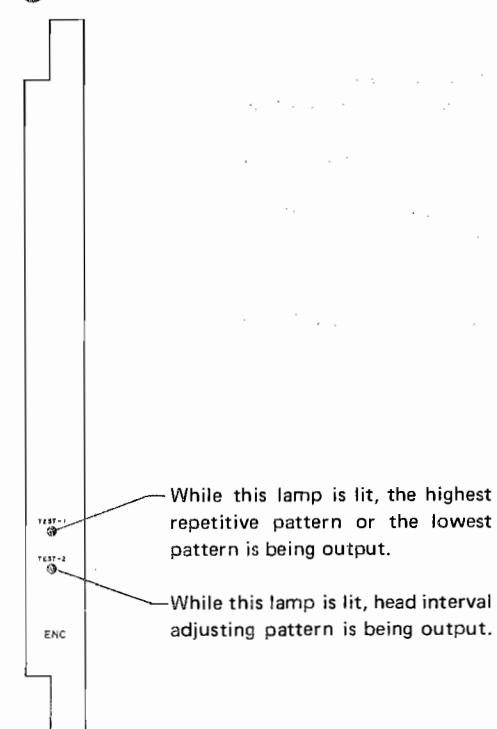
PIN NO.	NAME	PIN NO.	NAME
1	CH-1 IN -	2	CH-1 IN +
3	CH-2 IN -	4	CH-2 IN +
5	CH-3 IN -	6	CH-3 IN +
7	CH-4 IN -	8	CH-4 IN +
9	CH-5 IN -	10	CH-5 IN +
11	CH-6 IN -	12	CH-6 IN +
13	CH-7 IN -	14	CH-7 IN +
15	CH-8 IN -	16	CH-8 IN +
17	CH-9 IN -	18	CH-9 IN +
19	CH-10 IN -	20	CH-10 IN +
21	CH-11 IN -	22	CH-11 IN +
23	CH-12 IN -	24	CH-12 IN +
25	CH-13 IN -	26	CH-13 IN +
27	CH-14 IN -	28	CH-14 IN +
29	CH-15 IN -	30	CH-15 IN +
31	CH-16 IN -	32	CH-16 IN +
33	CH-17 IN -	34	CH-17 IN +
35	CH-18 IN -	36	CH-18 IN +
37	CH-19 IN -	38	CH-19 IN +
39	CH-20 IN -	40	CH-20 IN +
41	CH-21 IN -	42	CH-21 IN +
43	CH-22 IN -	44	CH-22 IN +
45	CH-23 IN -	46	CH-23 IN +
47	CH-24 IN -	48	CH-24 IN +
49	N.C.	50	N.C.

1-5. NAMES OF SWITCHES AND INDICATORS ON THE BOARD

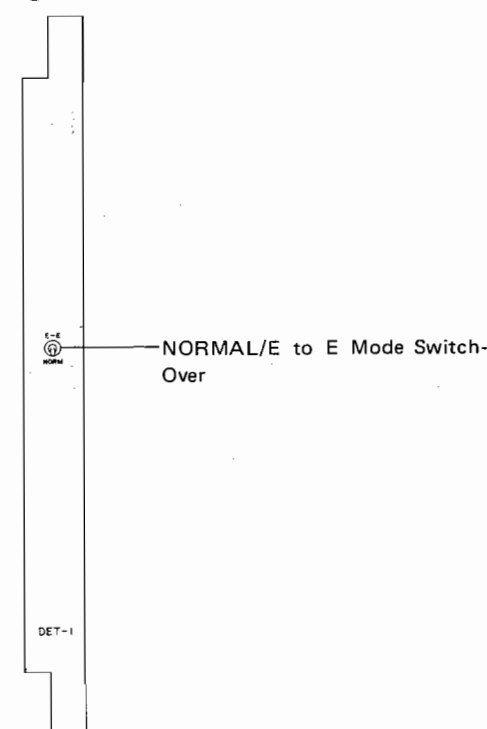


- | | | | |
|---------------|-----------------------|---------------|---------------|
| ① REC BOARD | ⑫ SEP BOARD | ⑳ EDT B BOARD | ㉔ ARP BOARD |
| ② ENC BOARD | ⑬ SEP BOARD | ㉕ DIN-1 BOARD | ㉕ A/D-1 BOARD |
| ③ ENC BOARD | ⑭ TBC BOARD | ㉖ DIN-2 BOARD | ㉖ A/D-2 BOARD |
| ④ ENC BOARD | ⑮ DEC BOARD | ㉗ DIN-3 BOARD | ㉗ A/D-3 BOARD |
| ⑤ DET-1 BOARD | ⑯ DEC BOARD | ㉘ MCPU BOARD | ㉘ A/D-4 BOARD |
| ⑥ DET-2 BOARD | ⑰ DEC BOARD | ㉙ EIO BOARD | ㉙ A/D-5 BOARD |
| ⑦ DET-3 BOARD | ⑱ DCC BOARD | ㉚ CTL BOARD | ㉚ A/D-6 BOARD |
| ⑧ SEP BOARD | ㉑ | ㉛ LOC BOARD | ㉛ D/A-1 BOARD |
| ⑨ SEP BOARD | ㉒ VCLK BOARD (OPTION) | ㉜ SYS BOARD | ㉜ D/A-2 BOARD |
| ⑩ SEP BOARD | ㉓ CLK BOARD | ㉝ SRVO BOARD | ㉝ D/A-3 BOARD |
| ⑪ SEP BOARD | ㉔ EDT A BOARD | ㉞ TCT BOARD | ㉞ D/A-4 BOARD |
| | | | ㉞ D/A-5 BOARD |
| | | | ㉞ D/A-6 BOARD |

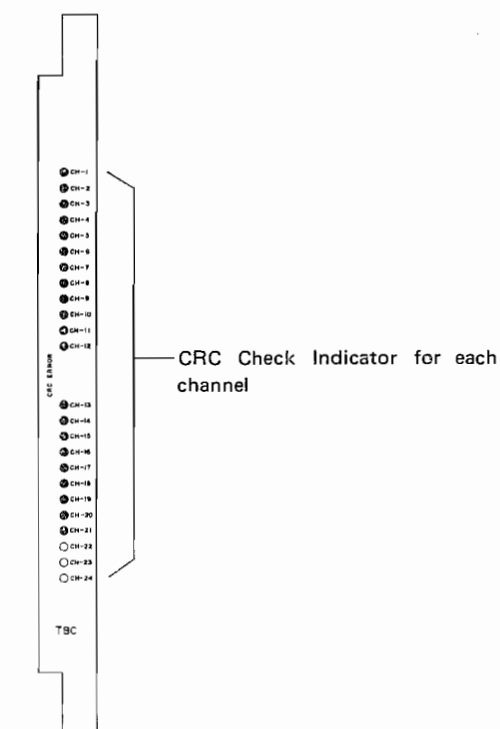
22 ENC
23 ENC
24 ENC



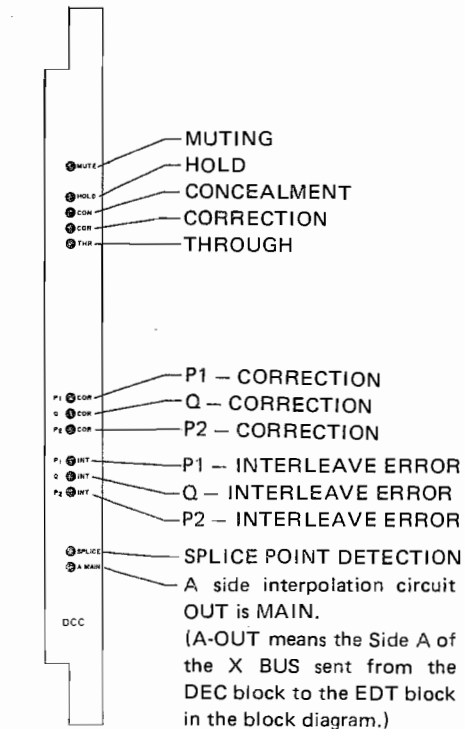
15 DET-1
16 DET-2
17 DET-3



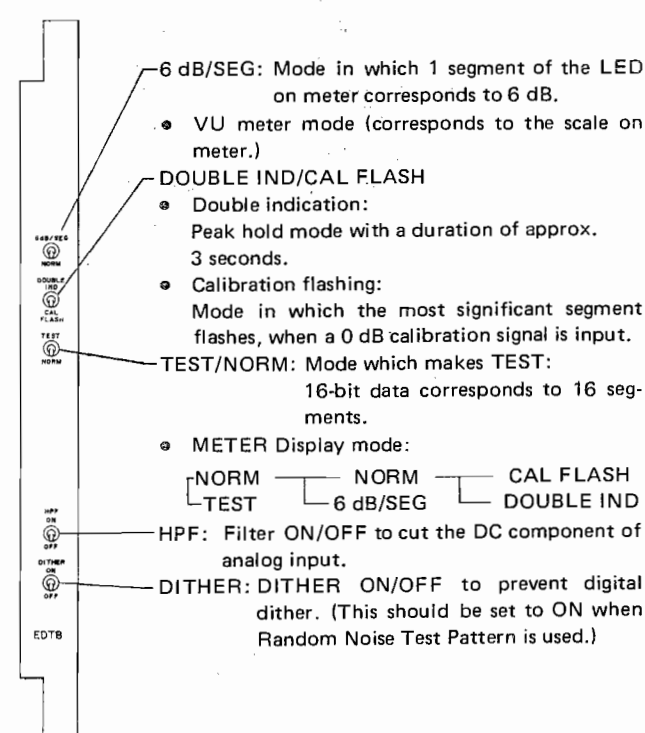
14 TBC



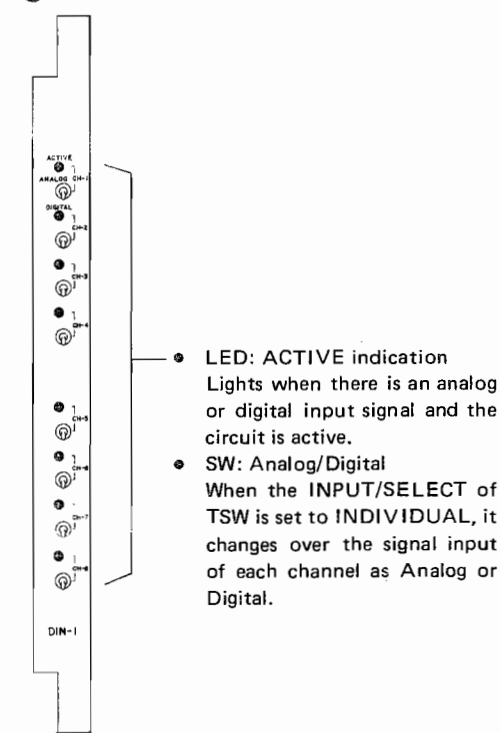
18 DCC



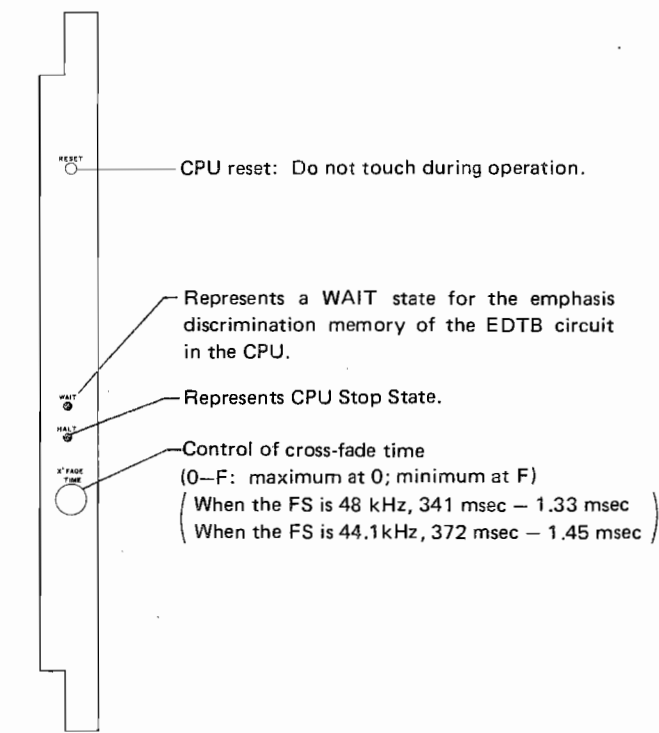
23 EDT B



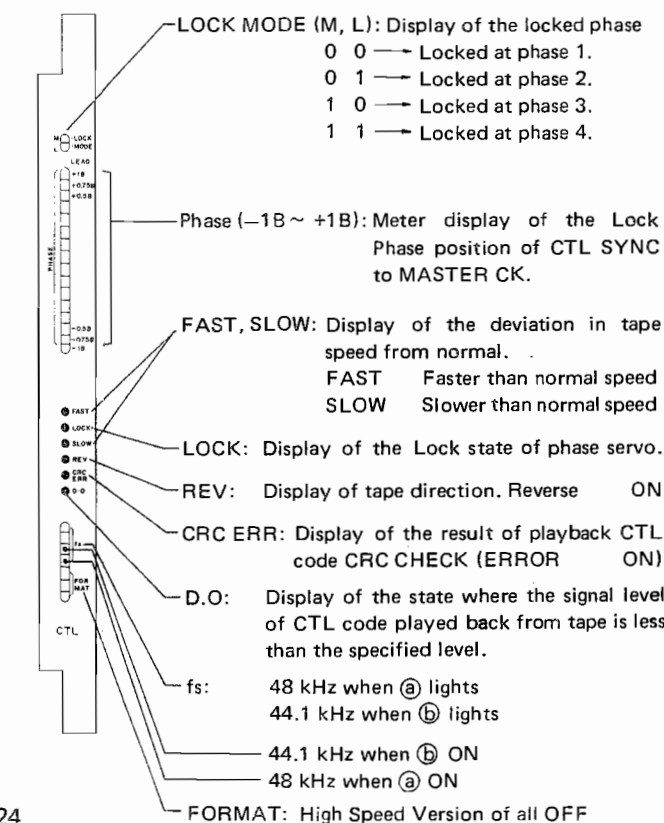
24 DIN-1
25 DIN-2
26 DIN-3



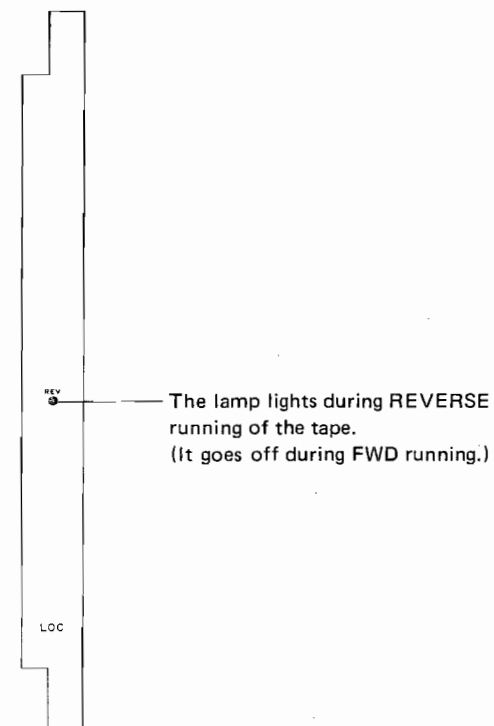
27 MCPU



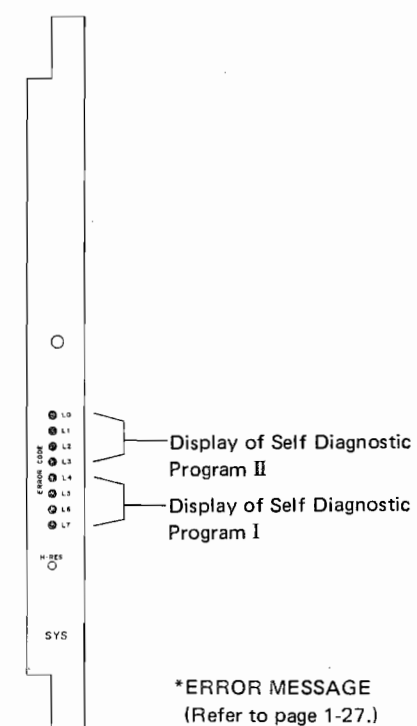
29 CTL



30 LOC



31 SYS



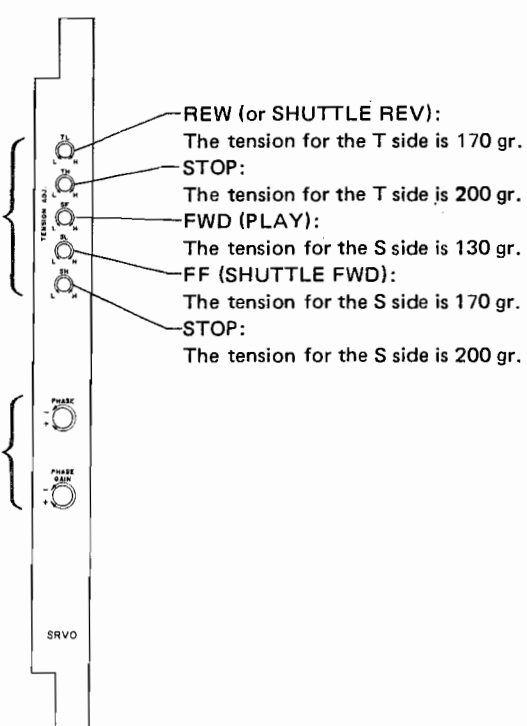
32 SRVO

TAPE TENSION ADJ :

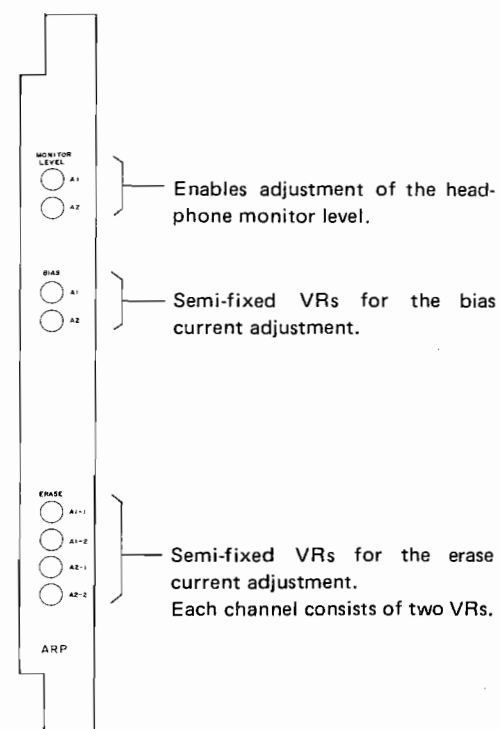
Turning this knob towards L decreases the tension.
(Turning this knob towards H increases the tension)

SERVO PLL PHASE ADJ :

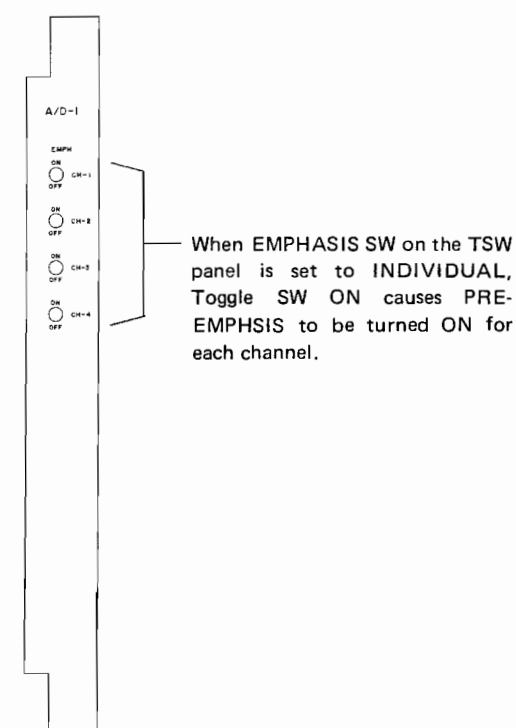
In the REC (ADVANCE REC) mode, regardless of the fs (48 kHz or 44.1 kHz), it should be adjusted so that the PHASE METER on the CTL Board indicates the center.



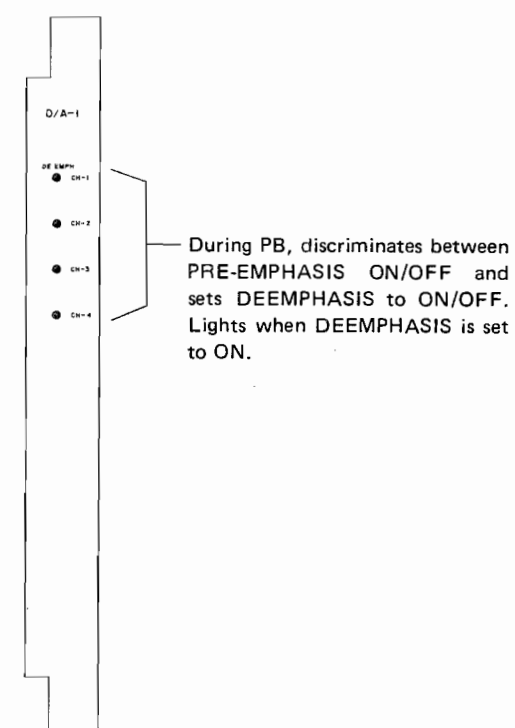
34 ARP



- 35 A/D-1
- 36 A/D-2
- 37 A/D-3
- 38 A/D-4
- 39 A/D-5
- 40 A/D-6



- 41 D/A-1
- 42 D/A-2
- 43 D/A-3
- 44 D/A-4
- 45 D/A-5
- 46 D/A-6



Switch position at the factory

Boards	Switches	Switch positions
DET-1, -2, -3	NORMAL/E to E	NORMAL
EDT B	6 dB/NORMAL	NORMAL
	DOUBLE/FLASH	FLASH
	TEST/NORMAL	NORMAL
	HPF ON/OFF	ON
DIN-1, -2, -3	DITHER ON/OFF	ON
	ANALOG/DIGITAL	ANALOG
A/D-1, N-6	EMPH ON/OFF	ON

***ERROR MESSAGES**

System-controller error messages are output to LED1 – LED8 on the System-controller board.

They are divided into two 4 bit-groups, which output messages respectively.

LEDs 4 to 1 (lower 4 bits on the board) output the SELF-DIAGNOSIS I error messages.

LEDs 8 to 5 (upper 4 bits on the board) output the SELF-DIAGNOSIS II error messages.

The LED patterns correspond to the error modes shown in Tables 1 and 2.

LED8	LED1	LED6	LED5	MESSAGE
			(OFF)	Normal
			ON	+15V abnormal
		ON		–15V abnormal
		ON	ON	SERVO CLOCK abnormal
	ON			CAPSTAN SPEED is too fast
	ON		ON	GEARED MOTOR position abnormal
	ON	ON		MOTOR temperature abnormal high for 10 minutes continuously
	ON	ON	ON	REEL RESET causing shut off (Not error)
ON				Shut off due to no tape (Not error)
ON			ON	MOTOR temperature abnormally high
ON		ON		CAPSTAN, TIMER ROLLER, T-REEL, and S-REEL do not rotate in the same direction
ON		ON	ON	Reel running or threading error
ON	ON			Reel running or reel FG abnormal
ON	ON		ON	Tape tension abnormal or threading error
ON	ON			Undecided
ON	ON	ON	ON	

TABLE 2: SELF-DIAGNOSIS II ERROR MESSAGES

LED4	LED3	LED2	LED1	MESSAGE
			(OFF)	Normal
			ON	SYS-CON-SERVO INTERFACE abnormal
		ON		RAM abnormal
		ON	ON	TIMER ROLLER is rotating
	ON			± 15V abnormal
	ON		ON	SERVO CURVE (??) GENERATOR abnormal
	ON	ON		MOTOR temperature abnormally high
	ON	ON	ON	MS1 or GEARED MOTOR abnormal
ON				MS2 or GEARED MOTOR abnormal
ON			ON	Tape tension abnormal or threading error
ON		ON		Undecided
ON	ON	ON	ON	

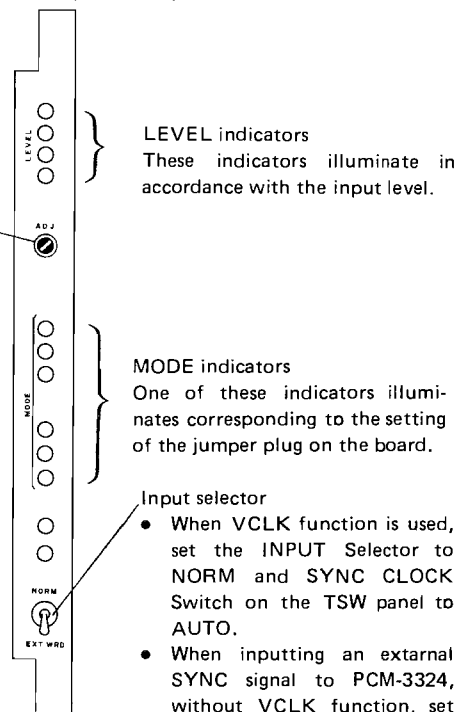
TABLE 1: SELF-DIAGNOSIS I ERROR MESSAGES

20 VCLK (OPTION)

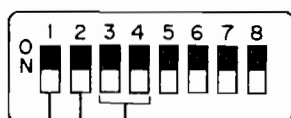
LEVEL ADJ volume
This adjusts the input level.

Operation check indicators
The green LOCK LED illuminates when the PCM-3324 is synchronized with the input signal. While the PCM-3324 is not synchronized or when synchronization is impossible, the red ERROR LED blinks or illuminates.

For detail,
Refer to the DABK-3000 operation and maintenance manual.



1-5-1. Switches on the ENC Board
(Select switches for the recording test pattern)



All switches are set to OFF at the factory.

Using these SWs, the 4-block length and 28-block length signals are respectively sent to REC AMP.

3	4	MODE
(OFF)		Normal mode
	ON	4-block length signal to REC AMP
ON		Two-times fs
ON	ON	28-block length signal to REC AMP

- When either SW3 or SW4 is set to ON, the TEST-2 LED lights to indicate the TEST mode.

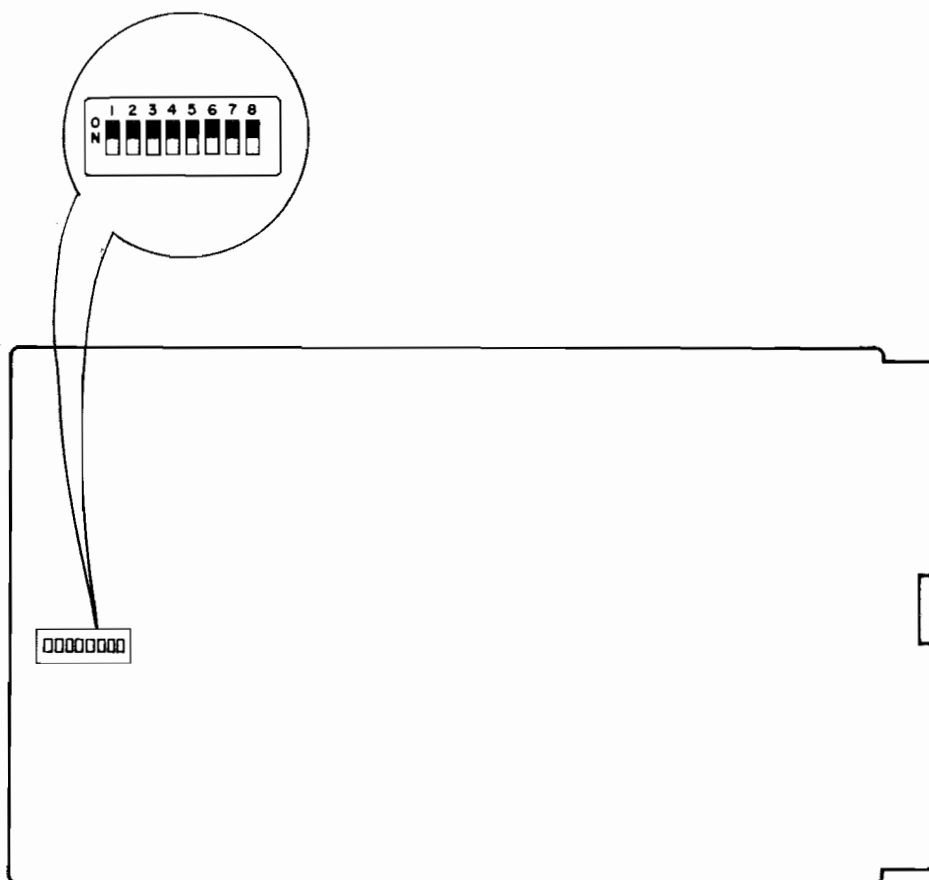
ON: When No. 1 of the SW is set at ON, generates a repeated pattern of 1.5T.

OFF: When No. 1 of the SW is set to ON, generates a repeated pattern of 1.5T to 4.5T.

ON: Generates automatically the test pattern.

OFF: NORMAL mode

- When set to ON, the TEST-1 LED lights to indicate the TEST mode.



ENC BOARD (COMPONENT SIDE)

1-5-2. Switches on the DCC Board

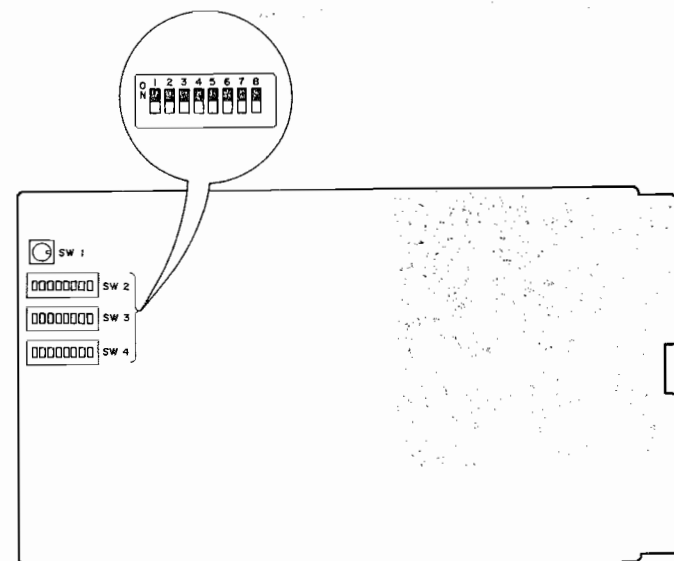
SW1: Sets so that MUTE mode is readily entered.

SWITCH				MODE
1	2	3	4	
ON	ON	ON	ON	Not to enter MUTE mode.
(OFF)	ON	ON	ON	
ON		ON	ON	
		ON	ON	
ON	ON		ON	
	ON		ON	
ON			ON	
ON	ON	ON		Difficult to enter MUTE mode.
	ON	ON		
ON		ON		
		ON		
ON	ON			
	ON			
ON				
				Readily to enter MUTE mode. (No interpolation is permitted.)

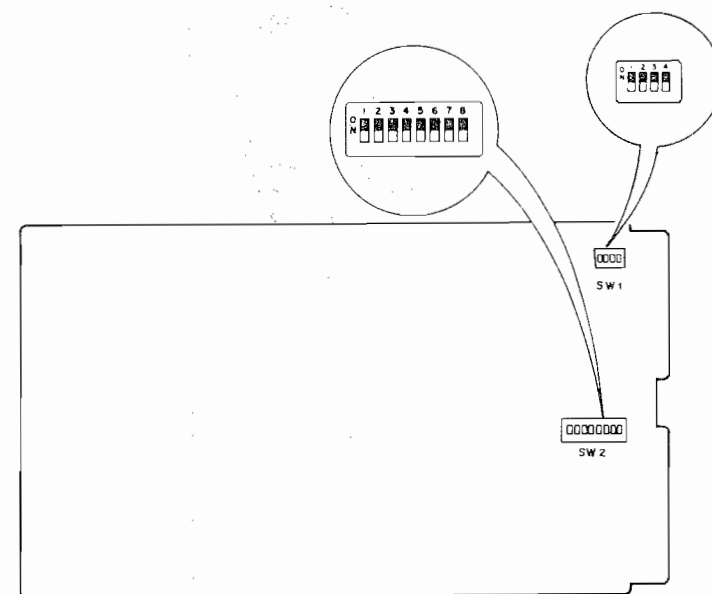
SW2: Selects the Mute-P2 INT LED display and CHANNEL on the DCC board panel.

SW1	1	2	3	4	5	6	7	8
CHANNEL								
* 1	ON	ON	ON	ON	ON	ON	ON	ON
2	(OFF)	ON	ON	ON	ON	ON	ON	ON
3	ON		ON	ON	ON	ON	ON	ON
4			ON	ON	ON	ON	ON	ON
5	ON	ON		ON	ON	ON	ON	ON
6		ON		ON	ON	ON	ON	ON
7	ON			ON	ON	ON	ON	ON
8				ON	ON	ON	ON	ON
9	ON	ON	ON		ON	ON	ON	ON
10		ON	ON		ON	ON	ON	ON
11	ON		ON		ON	ON	ON	ON
12			ON		ON	ON	ON	ON
13	ON	ON			ON	ON	ON	ON
14		ON			ON	ON	ON	ON
15	ON				ON	ON	ON	ON
16					ON	ON	ON	ON
17	ON	ON	ON	ON		ON	ON	ON
18		ON	ON	ON		ON	ON	ON
19	ON		ON	ON		ON	ON	ON
20			ON	ON		ON	ON	ON
21	ON	ON		ON		ON	ON	ON
22		ON		ON		ON	ON	ON
23	ON			ON		ON	ON	ON
24				ON		ON	ON	ON

* The channel 1 is usually set to the OPERATION mode at the factory.



MCPU BOARD (COMPONENT SIDE)



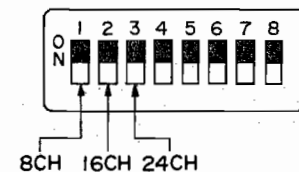
DCC BOARD (COMPONENT SIDE)

1-5-3. Switches on the MCPU Board

SW1: resets all the signals by the control system

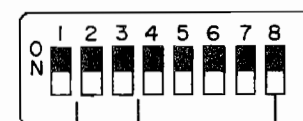
SW2: not used

SW3: sets the number of channels to be used



* Switches 1 ~ 8 of SW3 (counting from the left) are used to select the channel numbers when in the ON position. Usually only #3 is set ON. If all are OFF, 24CH is set automatically. (Positions 4 ~ 8 are not used.)

SW4:



ON: Memory cleared by reset
(BATTERY BACKUP mode)
OFF: backup

Set the Hold time of key board LEDs.

3	4	sec (approx)
ON	ON	2.4
(OFF)	ON	3.0
ON		3.6
*		4.2

Set the brightness of key board LEDs.
(completely dark in the "OFF, OFF" position)

1	2
(OFF)	
ON	
	ON
*	ON

brighter

* The switches 1 and 2 of SW4 are usually set to the OPERATION mode at the factory.

1-5-4. Switches on the CTL Board

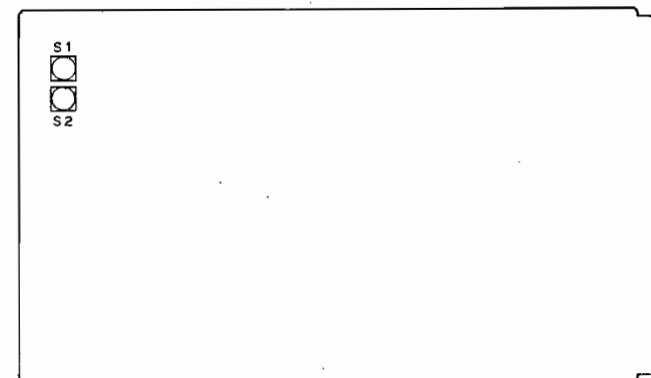
1. OFFSET CHECK (S2)

Check the OFFSET of the D/A converter which outputs PHASE ERROR.

When the SW is depressed, all input data of the D/A converter becomes 0.

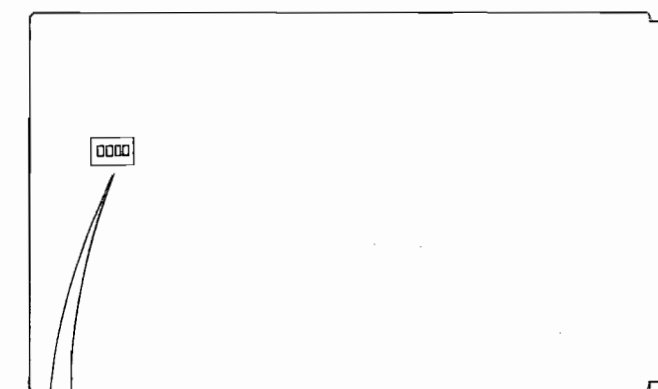
2. TAPE POSITION CHECK (S1)

When the SW is depressed, the replay CTL SYNC position is checked for slippage with respect to the SECTOR SYNC position of the MASTER CLK.



CTL BOARD (COMPONENT SIDE)

1-5-5. Switches on the SYS Board



SYS BOARD (COMPONENT SIDE)

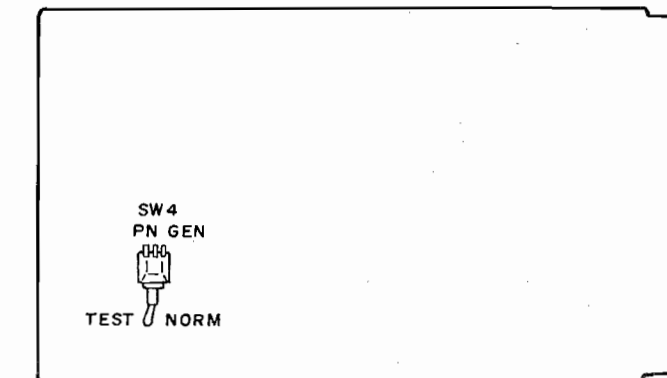
* The reel runaway detection circuit monitors the ratio of revolutions between the T-reel and S-reel. This SW is used to recognize reel runaway and to set the ratio of revolutions.

1	2	3	4	MODE
(OFF)				Reel runaway detector does not operate.
*	ON			Set when shipping.
	ON	ON		Usable area
ON	ON	ON		Unusable area
ON	ON	ON	ON	

The reel runaway detector becomes more sensitive.

1-5-6. Switches on the EDT B Board

When the DITHER ON/OFF switch on the EDT B board is set to ON and the random pattern generator switch (PN GEN SW4) is set to TEST, a random pattern is generated. Usually, set to NORM.



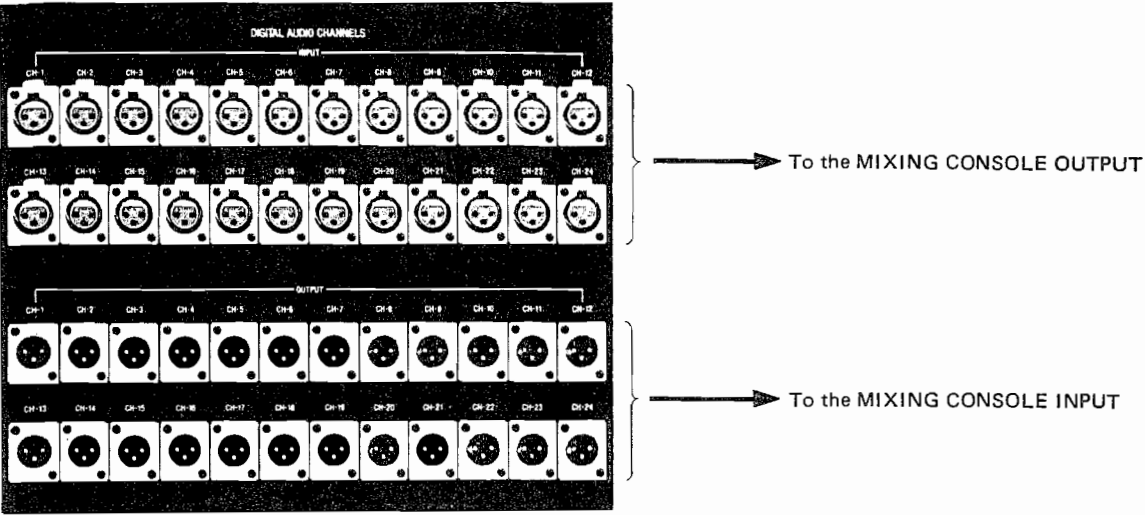
EDT B BOARD (COMPONENT SIDE)

* The PN GEN SW4 is usually set to the OPERATION mode at the factory.

1-6. CONNECTION

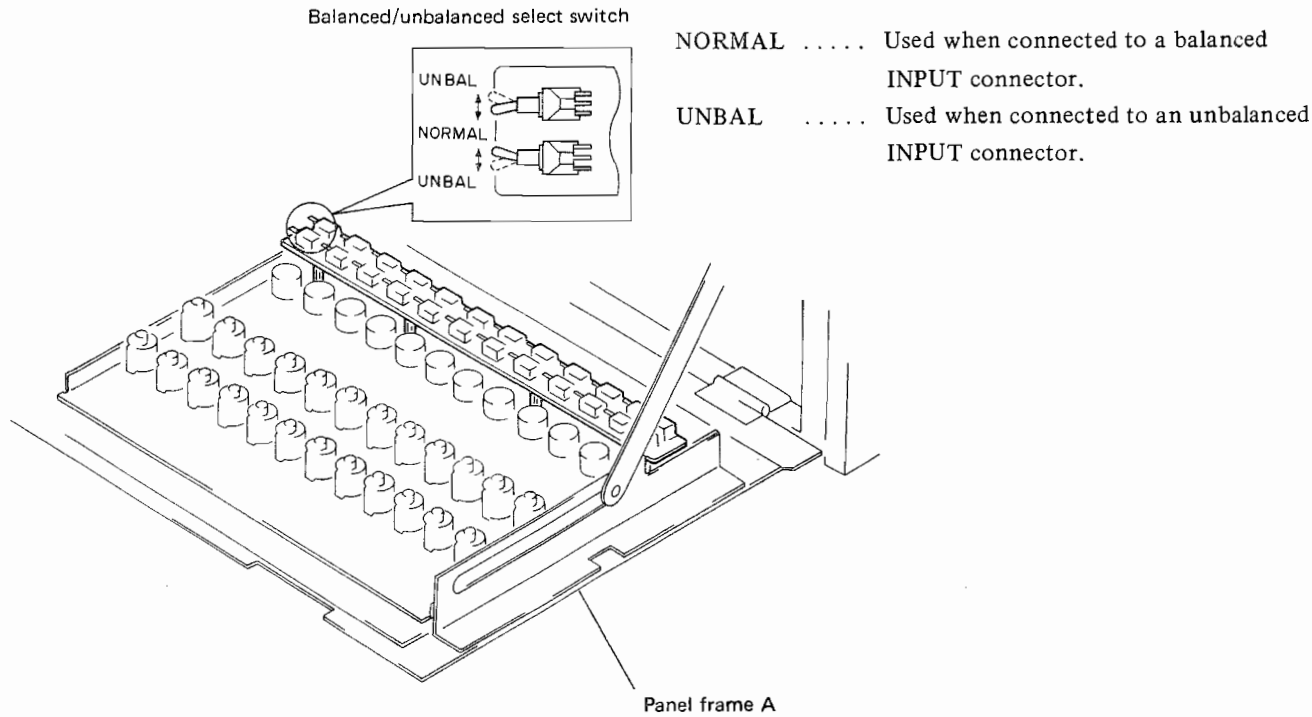
1-6-1. Connection to a Mixing Console

- The DIGITAL AUDIO CHANNEL CONNECTORS on the rear panel are used for connection to the mixing console INPUT and OUTPUT.
(The INPUT and OUTPUT reference level is +4 dBm.)

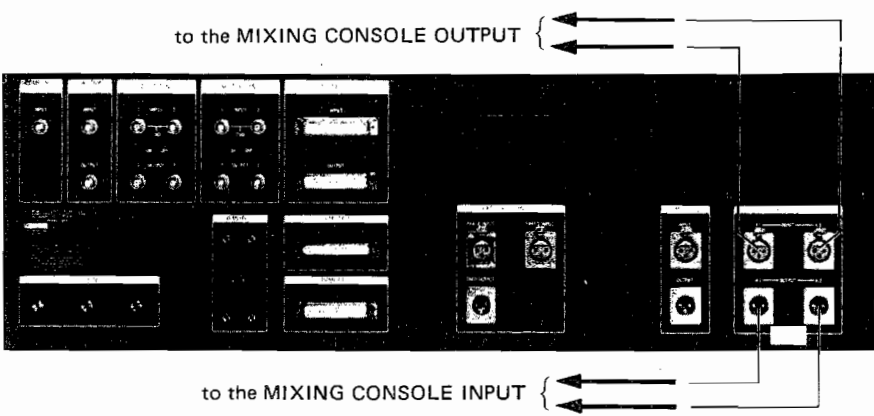


Note: When a digital audio OUTPUT connector is connected to the INPUT connector of an unbalanced mixing console, open the panel frame A as shown in the figure below and set each channel's balanced/unbalanced select switch in OUTPUT connector block to the "UNBAL" position.

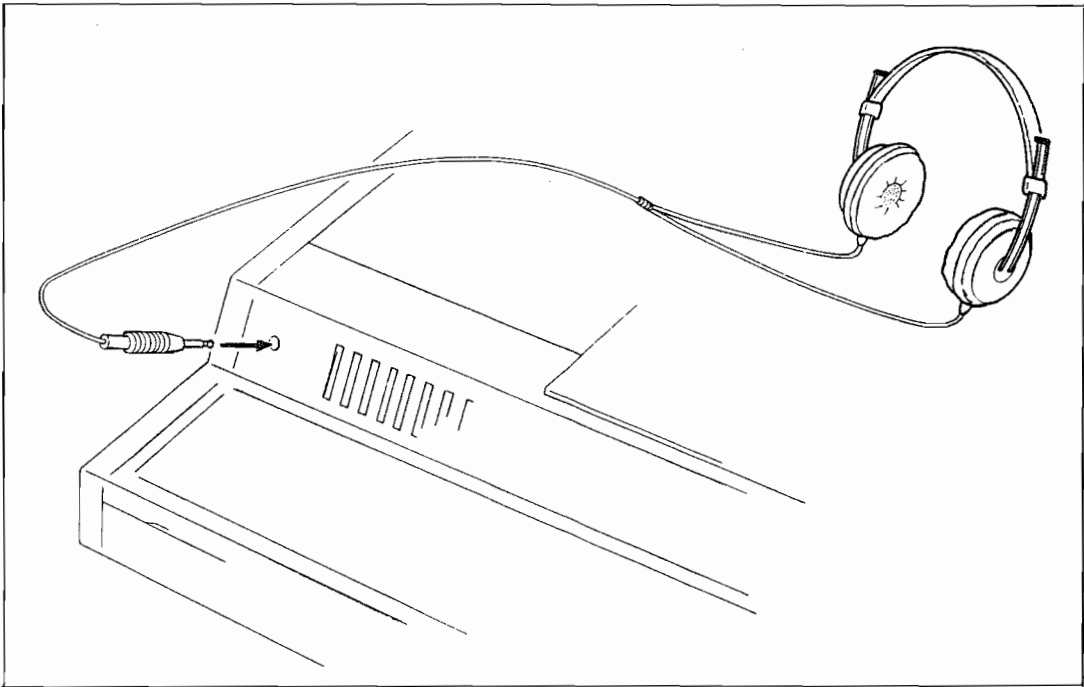
Also, when set to the "UNBAL" position, notice that the output level of OUTPUT connector is lower by 6 dB than that in the "NORMAL" position.



- Two input and output channels for monitoring may also be connected to the console in the same way.



- The output of the two monitor channels can be monitored by connecting headphones to the MONITOR socket.



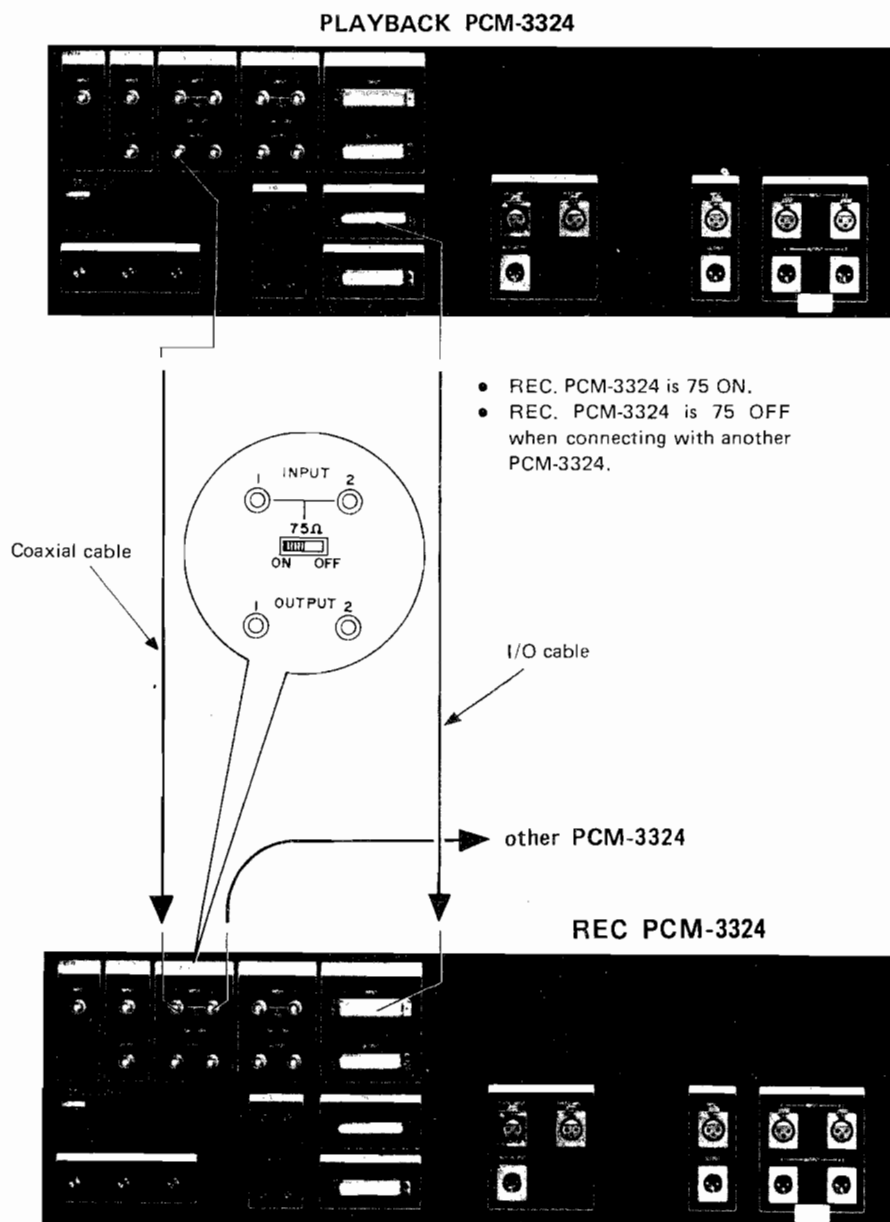
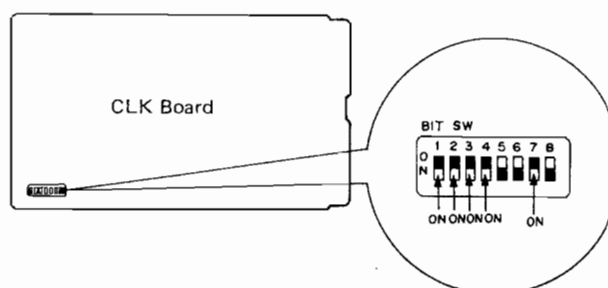
Note: The TIME CODE INPUT and OUTPUT CONNECTOR is not active. When you wish to record the TIME CODE, use the two monitor channels (A1, A2).

1-6-2. Connections for Digital Dubbing

- When digital dubbing between PCM-3324 units, it is necessary to synchronize the CLOCK systems and then connect the DIGITAL I/O connector.

Preparation

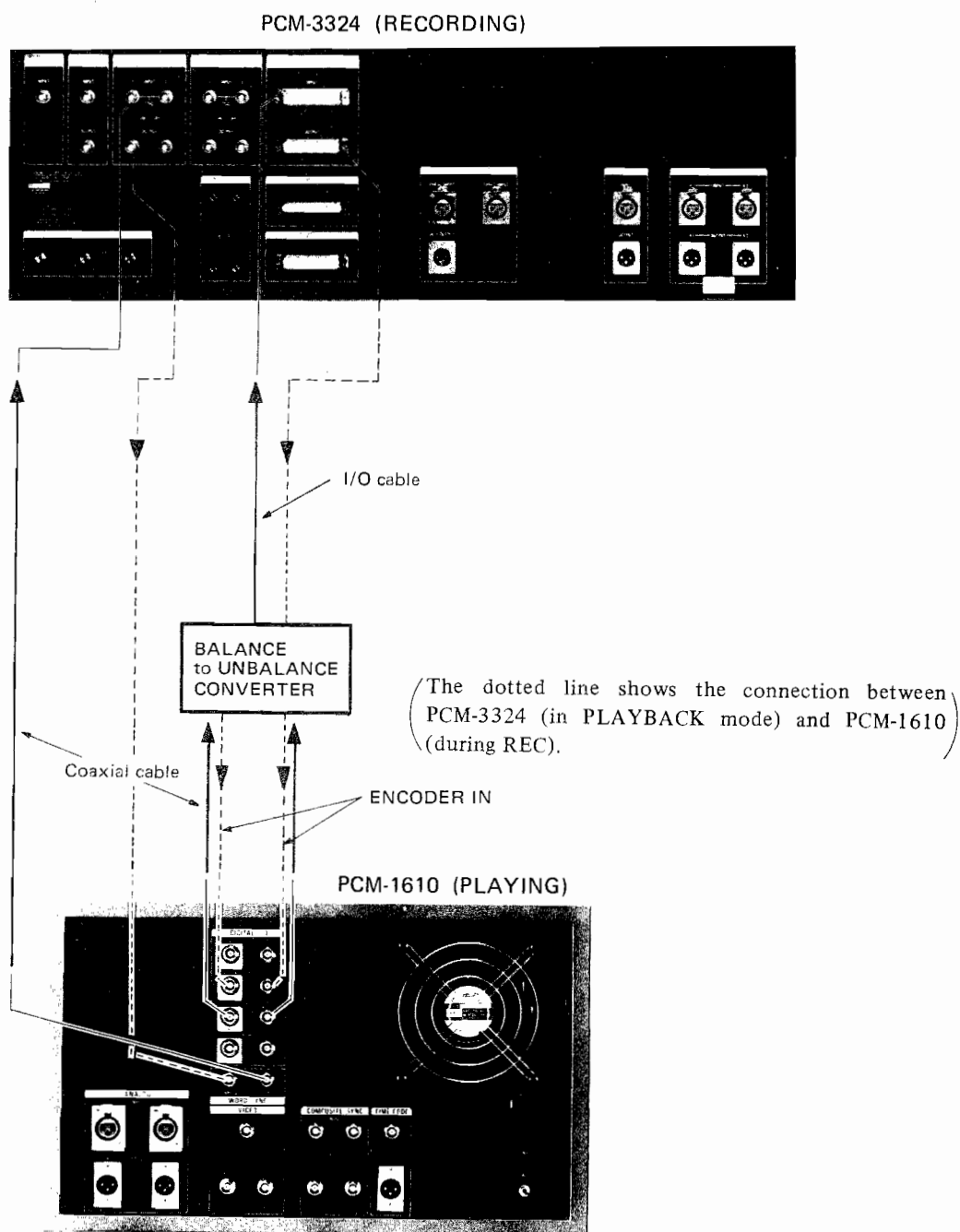
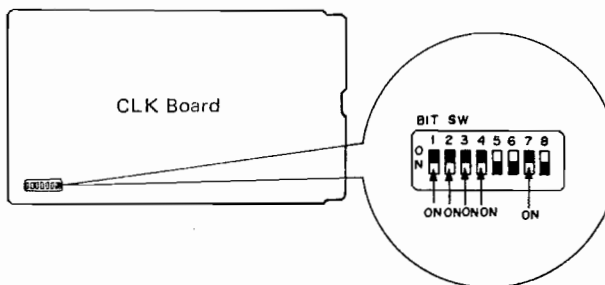
1. Check that the bit switches on the CLK board of the slave PCM-3324 are set as shown in the illustration.
2. Set the switches on the TSW panel of the slave PCM-3324 as follows.
 - INPUT SELECT → DIGITAL
 - SYNC CLOCK → AUTO
 - SAMPLING RATE → set in the same manner as the master PCM-3324.



• **Digital Dubbing between PCM-3324 and PCM-1610**

Preparation

1. Check that the bit switches on the CLK board of the PCM-3324 are set as shown in the illustration.
2. Set the switches on the TSW panel of the PCM-3324 as follows.
 - SAMPLING RATE → 44.1 kHz
 - INPUT SELECT → DIGITAL
 - SYNC CLOK → AUTO

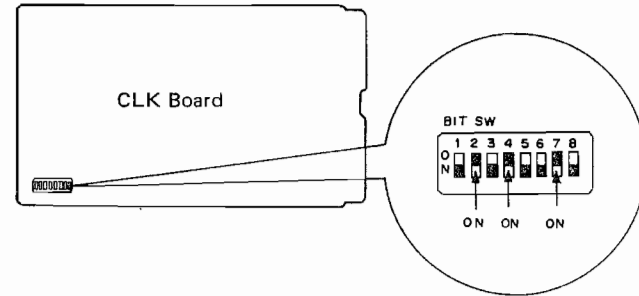


1-6-3. Connection to RM-3310

1. Preparation

To remotely control the PCM-3324 with the RM-3310, prepare the PCM-3324 as described below.

- ① Set the dip switches 2, 4 and 7 on the CLK board to ON.



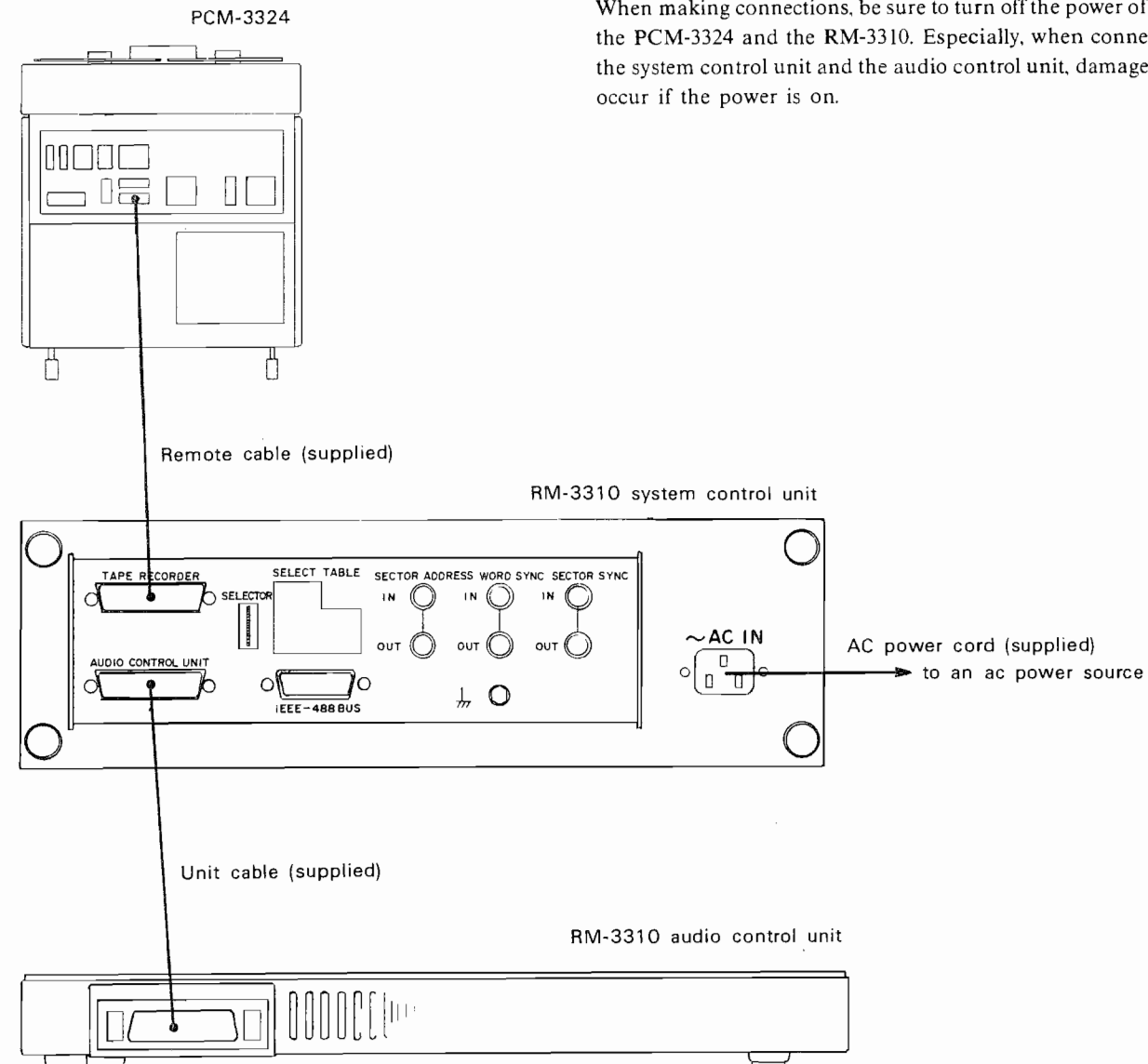
- ② Make sure that all dip switches on the EIO board are set to OFF.
- ③ Set the SYSTEM CONTROL switch on the TSW panel to REMOTE3
 - When the PCM-3324 is set in the REMOTE mode, switches and keys on the PCM-3324 (except for the TENSION DISARM switch, SHUTTLE dial and MASTER SAFE switch) do not function.

To use a PCM-3324

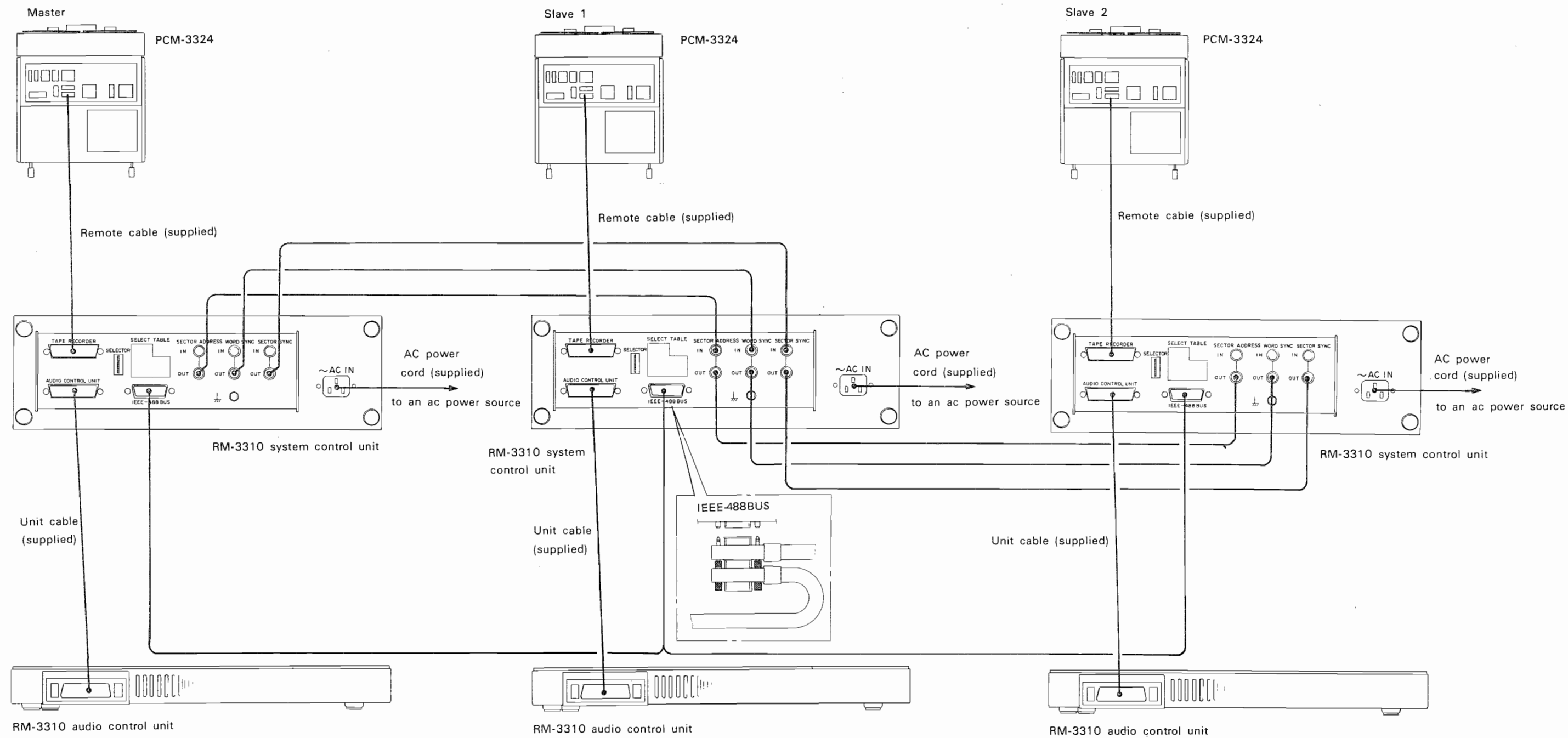
2. Connections

Note

When making connections, be sure to turn off the power of both the PCM-3324 and the RM-3310. Especially, when connecting the system control unit and the audio control unit, damage may occur if the power is on.



To synchronize two or three PCM-3324s



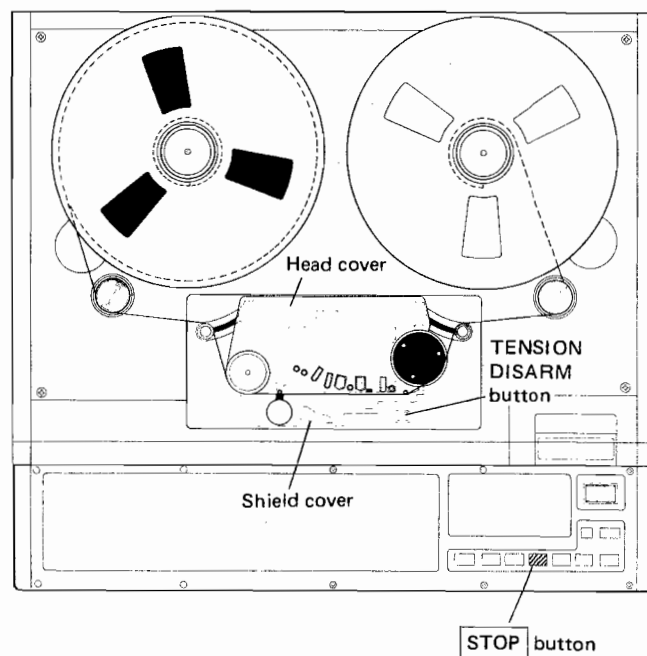
1-7. OPERATION

1-7-1. Tape Loading

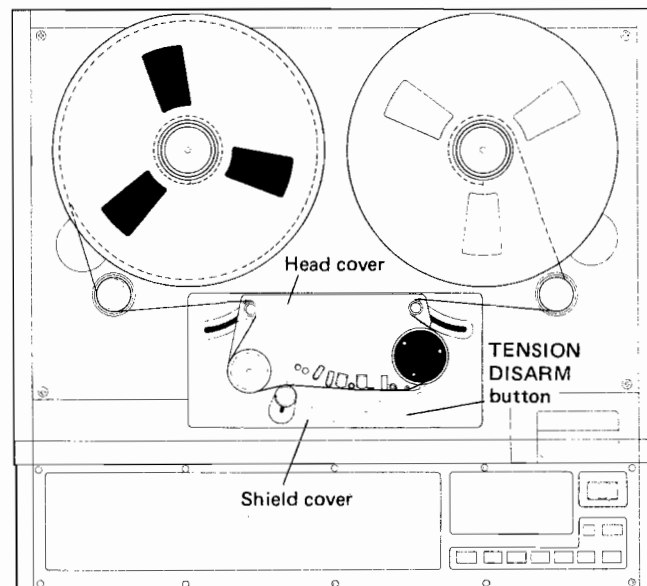
1. As shown in Fig. 1, load the tape so that it is not slackened. At this time, the **STOP** button lamp heeps flashing with the state unloaded (i.e. with no tension servo locked).
2. Then, in the state described in Step 1, when the **TENSION DISARM** button on the shield cover is depressed, the tension servo is locked with the state loaded (Fig. 2). At this time, the **STOP** button lamp remains lit.
(When the **TENSION DISARM** button is depressed again, the tension servo is released with the state unloaded as shown in Fig. 1.)

Note: Notice that excessive tape slacking causes the erroneous operation and the tape or tension arm damage.

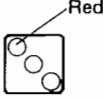
Unloading state



STOP state



1-7-2. Recording Procedure

- 1 Set the tape as shown in the illustration on page 3.
Depress the TENSION DISARM button attached to the sealed cover, lock the servo and confirm that the **STOP** button changes from flashing to lighting.
- 3 Check the TSW panel.
 - Refer to the "Names and Functions of TSW Panel".
- 4 Set the CH to be recorded to REC READY MODE.
- 5 Select REC MODE.
- 6 Depress **PLAY** and **REC**.
 - Make sure that the red lamp of REC INDICATOR  is lit.
- 7 AUTO PUNCH IN/OUT
 - AUTO PUNCH IN/OUT rehearsal
 - (1) Set the CH to be recorded to REC READY MODE.
 - (2) Set the REC MODE to SYNC REC MODE (ASSEMBLE or INSERT).
 - (3) a. Depress **PLAY** The monitor mode is **REPRO**.
 b. Depress **PLAY** and **REC REHEARSE** ... The cut-in point is decided.
 The monitor mode is **REPRO** → **INPUT**.
 c. Depress **PLAY** The cut-out point is decided.
 The monitor mode is **INPUT** → **REPRO**.
 d. Depress **STOP** The monitor mode is **INPUT**.
 e. Depress **AUTO PUNCH** and **REC REHEARSE**.
 The tape, after pre-rolling for 5 seconds from the cut-in point, enters the **PLAY** mode (The monitor mode is **REPRO**.), and at the cut-in point, it enters the **PLAY** and **REC PEHEARSE** mode (the monitor mode is **INPUT**). And at the cut-out point, the tape enters the **PLAY** state again, and after postrolling (the monitor mode is **REPRO**) for 5 seconds, stops.
 (The monitor mode is **INPUT**).
 - (4) After confirming the operations in (3), depress **AUTO PUNCH** and **REC**. The tape performs the same operations as in e. above, but at the cut-in point, it enters the **PLAY** & **REC** state, and recording is performed.
- 8 Analog track recording
 - (1) Set the analog CH A1 and A2 to REC READY MODE.
 - (2) Depressing **PLAY** will then execute recording.
Both **REPRO** and **INPUT** will light, but the input is monitored.

1-7-3. Reproducing Procedure

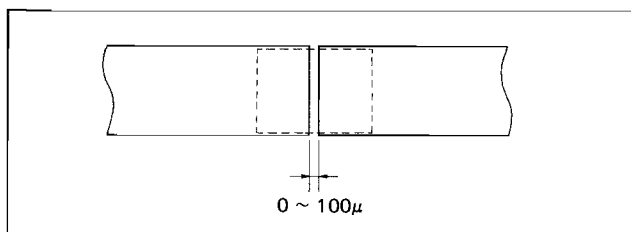
- 1 Set the tape as shown in the illustration on page 3.
- 2 Depress the TENSION DISARM button attached to the sealed cover, lock the servo and confirm that the **STOP** button changes from flashing to lighting.
- 3 Confirm the switch on the TSW panel.
 - Refer to the "Names and Functions of TSW Panel".
- 4 Depress **PLAY** button.
 - When the MONITOR display on the TSW panel is **AUTO INPUT**, depression of the **PLAY** button causes the monitor mode of all channels to automatically assume **REPRO** mode, with the result that the reproduced sounds for all channels are monitored.
 - When only a specified channel is required to be monitored, set the MONITOR display to **MANUAL** followed by setting the monitor mode of the channel to be monitored to **REC** mode, and then depress the **PLAY** button.

1-7-4. Editing

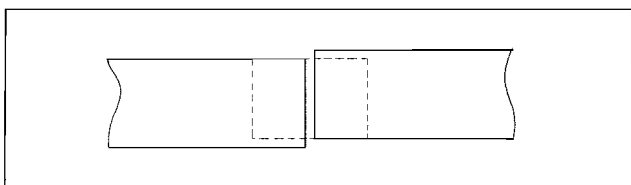
Manual Editing (Editing Precautions)

1. Mechanical conditions of the edit point

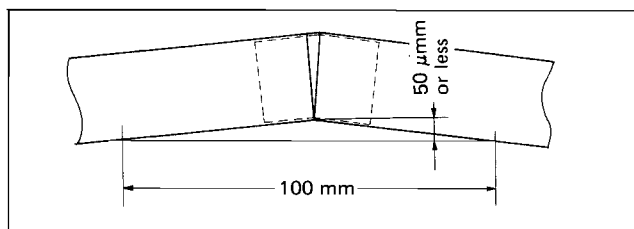
- 1) Gap at the edit point
The tape must not overlap at the edit point. A gap of about 50μ is best.



- 2) Mis-alignment at the edit point
The tape must not be allowed to be out of alignment at the edit point. If any mis-alignment is visible, the edit is not satisfactory.



- 3) Curving at the edit point
Angling or curving at the edit point must not be allowed. Beware of angled splices as shown in the illustration below.



If there are bends such as this at the edit point, tracking problems will result. Furthermore, the tension applied to the tape will not be right, and there will be an increase in errors in the vicinity of the edit.

- 4) Splicing tape
Do not allow the splicing tape to project out beyond the tape. Use scissors and cut off the splicing tape by cutting very slightly in to the tape. When cutting with a razor blade, set the edge of the tape in the guide from the magnetic side, and cut.

2. Manual editing; other precautions

- 1) Fingerprints
Try not to touch the tape
- 2) Tape edge
When editing the tape, be careful not to nick the edge of the tape. Be particularly careful that you don't cut the edge of the tape wavy.

3. Finishing the splice

- 1) Removing fingerprints
If you get fingerprints on the tape, rub them off with gauze moistened with a 6:4 mixture of alcohol and ether. Fingerprints can be removed from the back of the tape in the same way.
Alcohol is not able to remove fingerprints.

4. Recommended tools and splicing tapes

- 1) Splicing block
 - Tape splicer CY24 (optional accessories supplied)
- 2) Tape marker
 - SONY video marker M-970 (optional accessories supplied)
- 3) Cutting razor and scissors
 - Any non-magnetic material possible
- 4) Splicing tape
 - This is a splicing tape used for the audio, video and computer. Be sure to use a tape, made by polyester, of 1/2 in. in width and approx. 15 to 30μ in base thickness, respectively.

Reference tape

SCOTCH 620	NITTO 326
SCOTCH 8176	NITTO 323

1-8. REMOTE CONTROL OPERATION OF THE PCM-3324 USING THE RM-3310.

Refer to the RM-3310 operation and maintenance manual.

1. The first part of the document

2. The second part of the document

3. The third part of the document

4. The fourth part of the document

5. The fifth part of the document

6. The sixth part of the document

7. The seventh part of the document

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26. The twenty-sixth part of the document

27. The twenty-seventh part of the document

28. The twenty-eighth part of the document

29. The twenty-ninth part of the document

30. The thirtieth part of the document

31. The thirty-first part of the document

32. The thirty-second part of the document

33. The thirty-third part of the document

34. The thirty-fourth part of the document

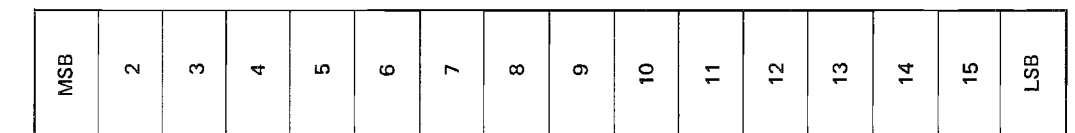
35. The thirty-fifth part of the document

1-11-1. Track Pattern on Magnetic Tape

(1) DATA TRACK BLOCK FORMAT

(1) DATA TRACK BLOCK FORMAT

[BLOCK]



Timing diagram for the 1-IDM-1 Encoder Input. The diagram shows the relationship between the SYNC WORD (16 bits), SYNC PATTERN (11 bits), BLOCK ADDRESS (3 bits), and FLAG BITS (2 bits) relative to the EFFECTIVE RANGE OF CRCC. It also shows the 1-IDM-1 ENCODER INPUT signal, which is a square wave with transitions labeled '0' and '1'. The input signal is shown in two states: '0' and '1'. The input signal is shown in two states: '0' and '1'.

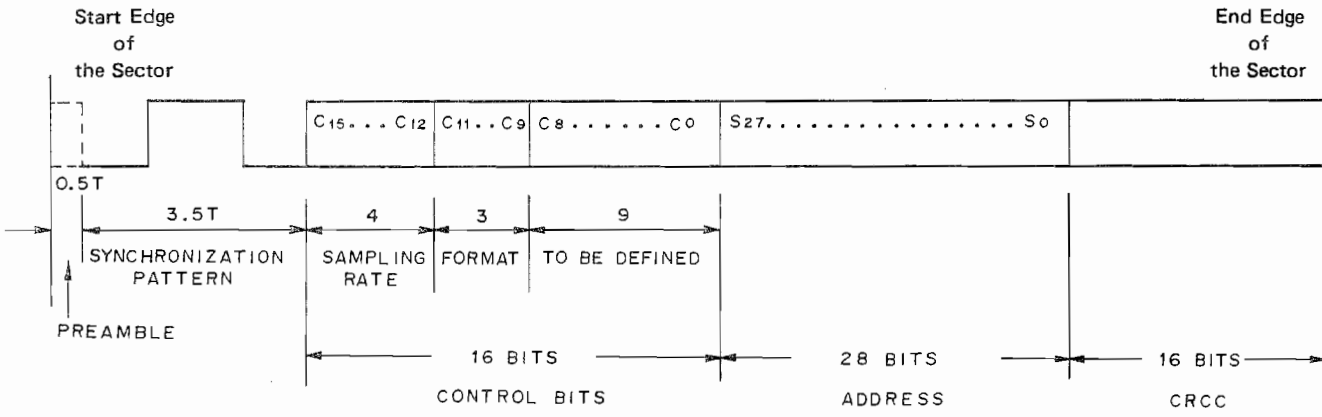
Input	B ₁	B ₀	W ₁	W ₀	F
0	0	0	W ₁	W ₀	F ₀
0	1	1	W ₁	W ₀	F ₁
1	0	0	W ₁	W ₀	F ₂
1	1	1	W ₁	W ₀	F ₃

1-45

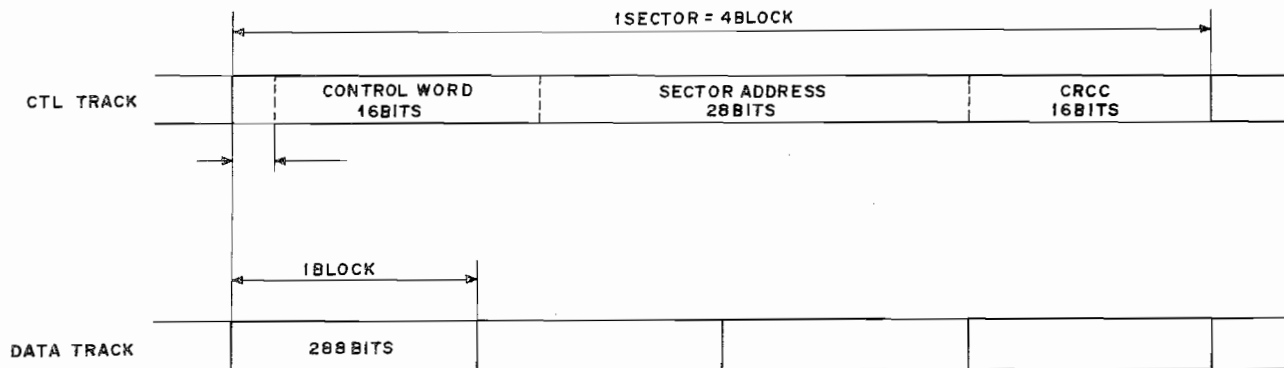
(2) CTL TRACK BLOCK FORMAT

One block on the control track is named as "SECTOR", the structure of which is defined below.

Item	Number of Bits
Preamble	0.5
Synchronization Pattern	3.5
Control Bits (Sampling Rate) (Format) (to be defined)	16 (4) (3) (9)
Sector Address	28
Error Detection (CRCC)	16

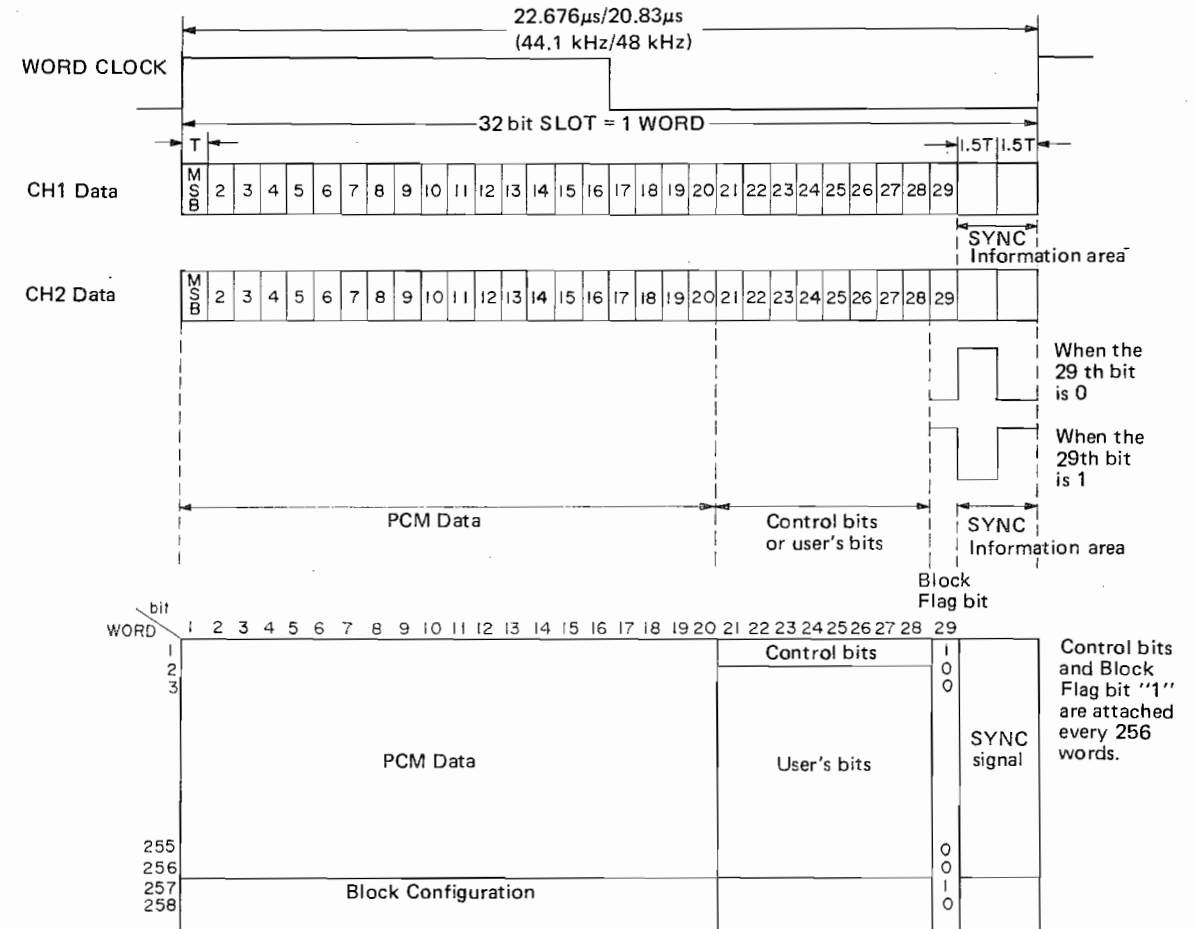


(3) RELATIONS BETWEEN CTL TRACK AND DATA TRACK

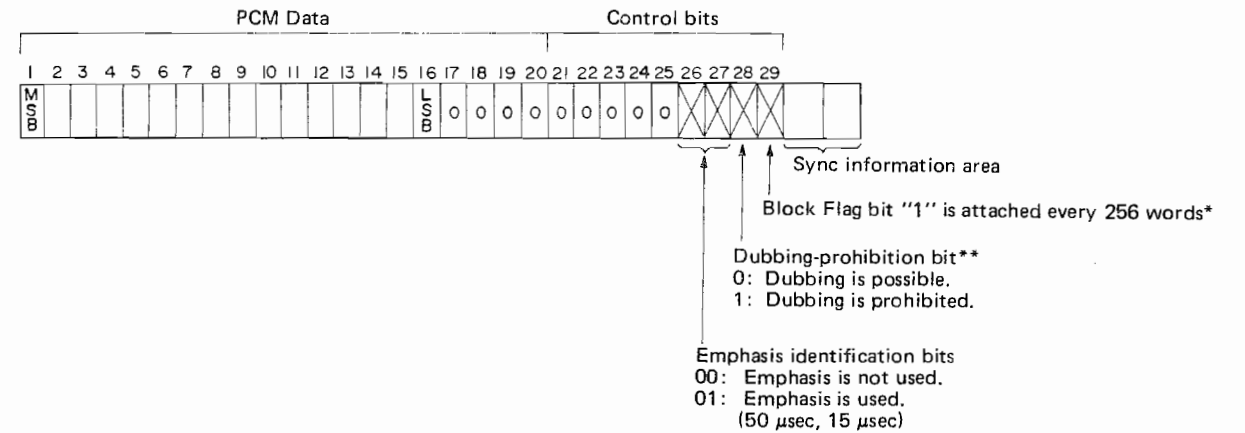


(4) DIGITAL I/O FORMAT

1. Digital input/output format

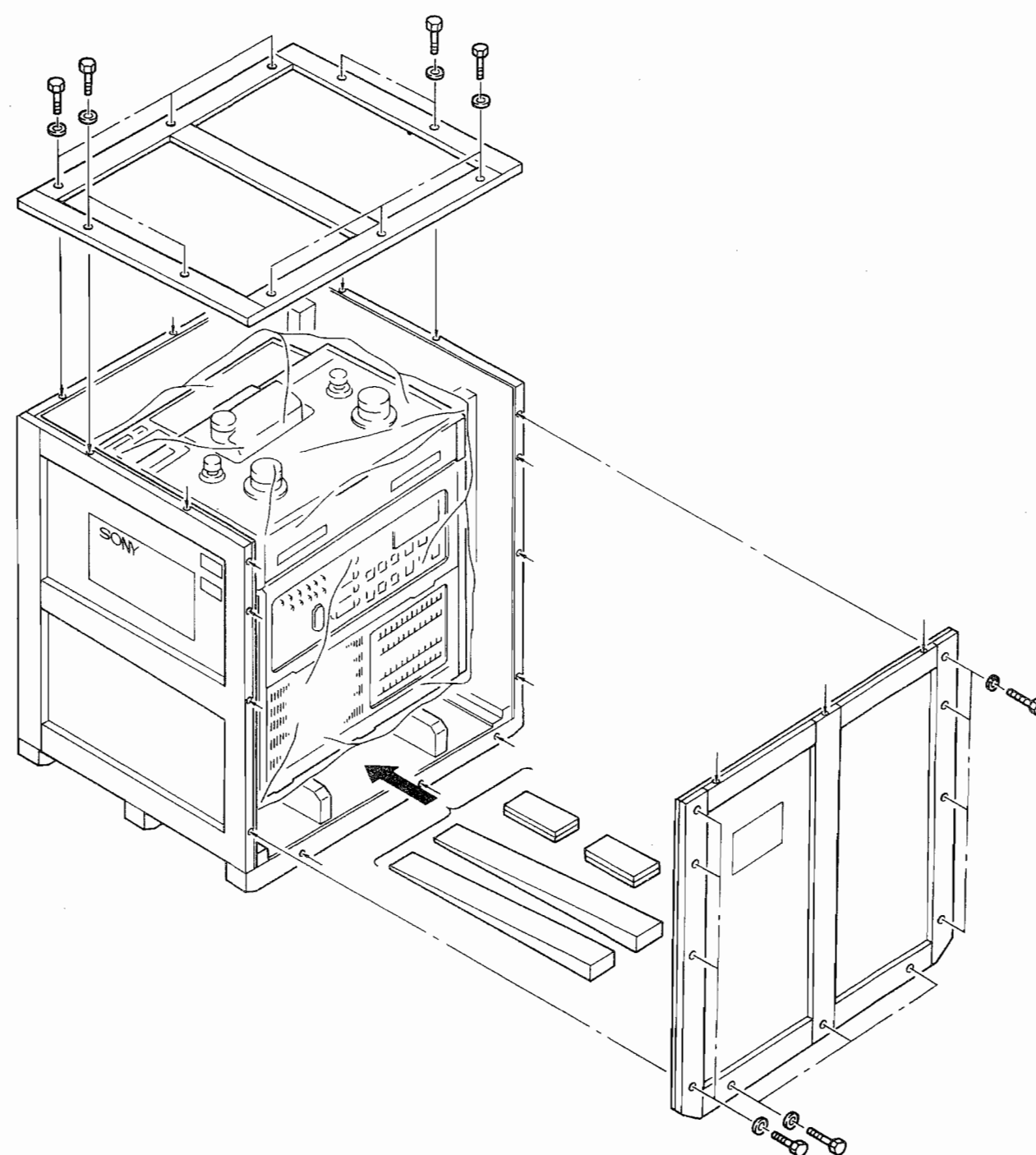
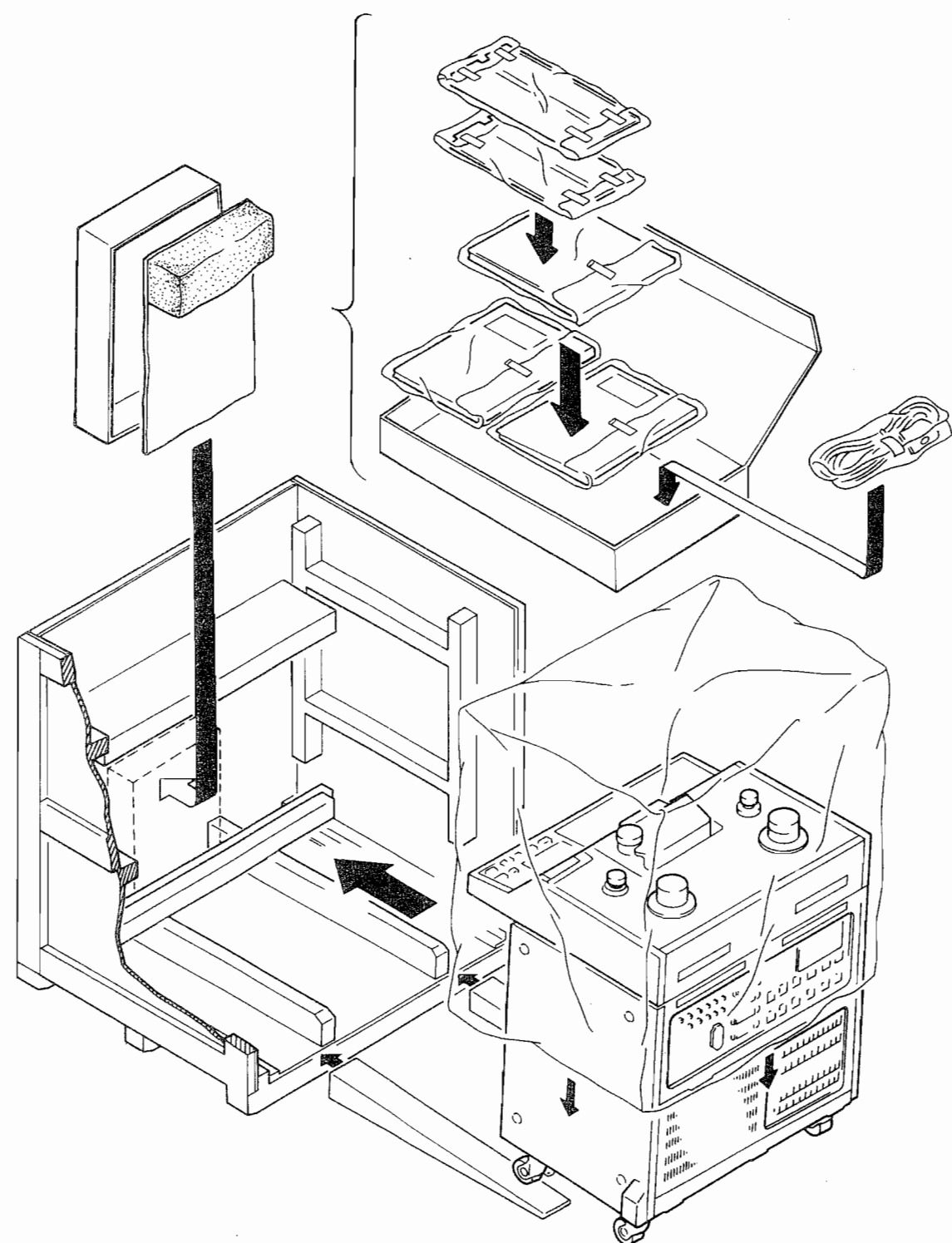


2. Control signal block structure



* When Block Flag bit is "0", Dubbing-prohibition bits and Emphasis identification bits are also "0".

** In the case of PCM-3324, Dubbing-prohibition bit is always "0".



SECTION 2

OUTLINE OF SYSTEM-CONTROL

2-1. DESCRIPTION OF TAPE TRANSPORT CONTROL

The mechanical control system description covers the following points:

- (1) Signal Flow Chart
- (2) SYSTEM-CONTROL Input/Output
- (3) SYSTEM-CONTROL Hardware
- (4) SYSTEM-CONTROL Software

2-1-1. Signal Flow

The input signals for Mechanism Control can be classified into 3 systems, Mechanism Function Key Inputs, Analog Shuttle Inputs, and Direct Inputs from Remote 1.

Function key signals are input to the SYSTEM-CONTROL via KEY ENCODER → MCPU → LOCATOR.

Analog shuttle signals are input to the SYSTEM-CONTROLLER via SERVO → LOCATOR.

Locator outputs operation mode and Lamp information to SYSTEM-CONTROLLER according to the following information:

Mechanism Key information input from MCP
Shuttle information input from SERVO
Mechanism status input from SYSTEM-CONTROLLER.
SYSTEM-CONTROL controls the following according to the mode input from Locator.

PLUNGER (To Plunger Driver)
Capstan Speed (To Servo)
Capstan Acceleration/Deceleration Rate (To Servo)
Tape Tension (To Servo)
Lamp Data (To Main CPU)
TALLY (To Remote 1)

Upon receiving lamp data, the MCPU lights the Mechanism Key Lamp via the Display Driver.

2-1-2. SYSTEM-CONTROL Input/Output

SYSTEM-CONTROL is interfaced with Locator, MCPU and Servo by 8-bit bi-directional buses. The data sent and received by each bus is as follows.

SYSTEM-CONTROLLER → LOCATOR;

Mecha status

SYSTEM-CONTROLLER ← LOCATOR;

Mode designation, Lamp data

SYSTEM-CONTROLLER → MCPU;

Lamp data (including flashing)

SYSTEM-CONTROLLER ← MCPU;

Note allocated

SYSTEM-CONTROLLER → SERVO;

Tension Control

Capstan Control

Speed Servo — Phase Servo switch

SYSTEM-CONTROLLER ← SERVO;

Mechanism Status including CD

(Capstan turning direction)

SYSTEM-CONTROLLER also directly inputs and outputs the following:

- (1) It outputs PLUNGER ON/OFF signal and GEARED MOTOR (Motor for retracting Tension Regulator) ON/OFF signal to Plunger Driver.
- (2) It drives the 8 LEDs (Error Message) on SYSTEM-CONTROLLER's circuit board.
- (3) It inputs mechanical information from each of the sensors on CTL and Mecha. The main information includes the following:
CTEMP (Capstan Motor Temperature Abnormal)
TTEMP (Take-Up Reel Temperature Abnormal)
STEMP (Supply Reel Temperature Abnormal)
TAPE (Presence of tape. This is used as a SHUT OFF signal.)
MS1 (GEARED Motor Position Sensor)
MS2 (GEARED Motor Position Sensor)
ARDH, L (PLL on Timing)
- (4) It inputs EXT SPD and SYNC commands from Remote 1.
- (5) It outputs TALLY.
- (6) It turns Head Timer on or off.
- (7) It turns Motor Power on or off.

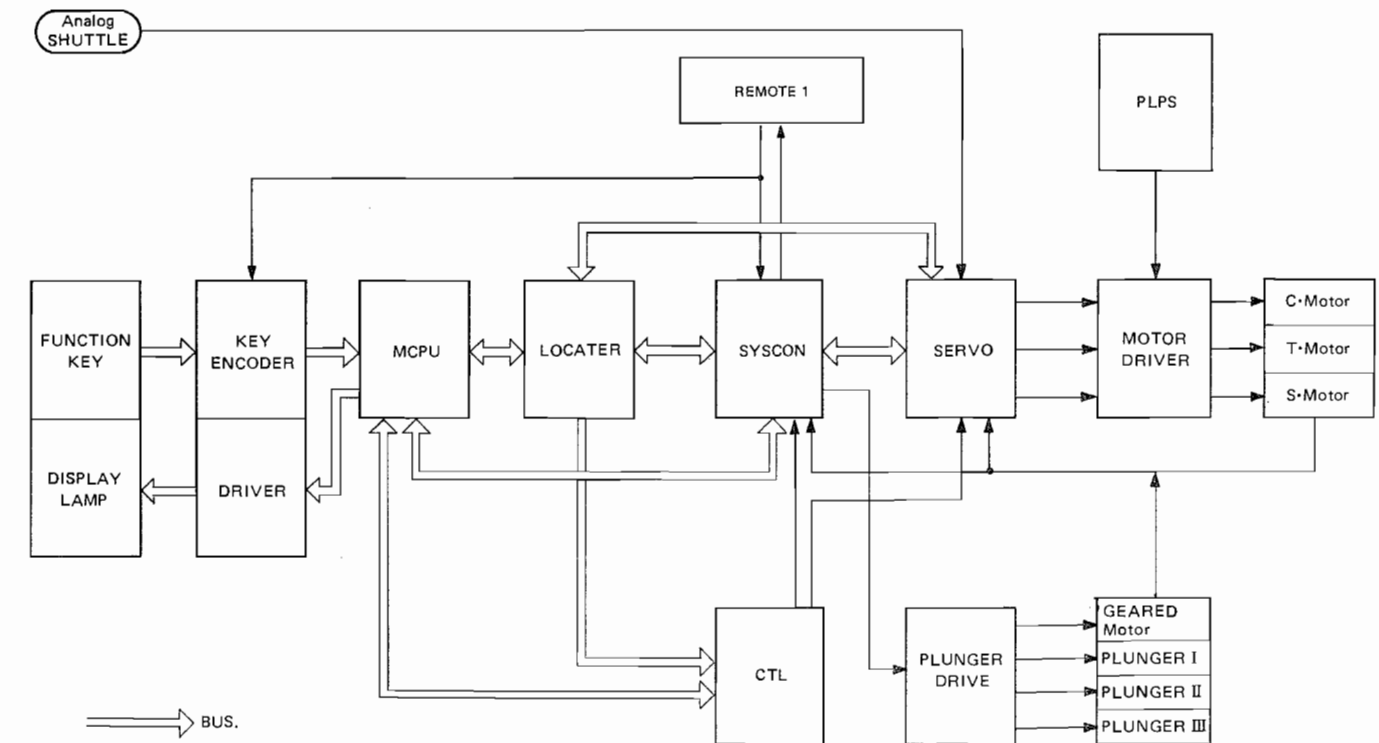


Fig. 2-1. Mechanism control block diagram

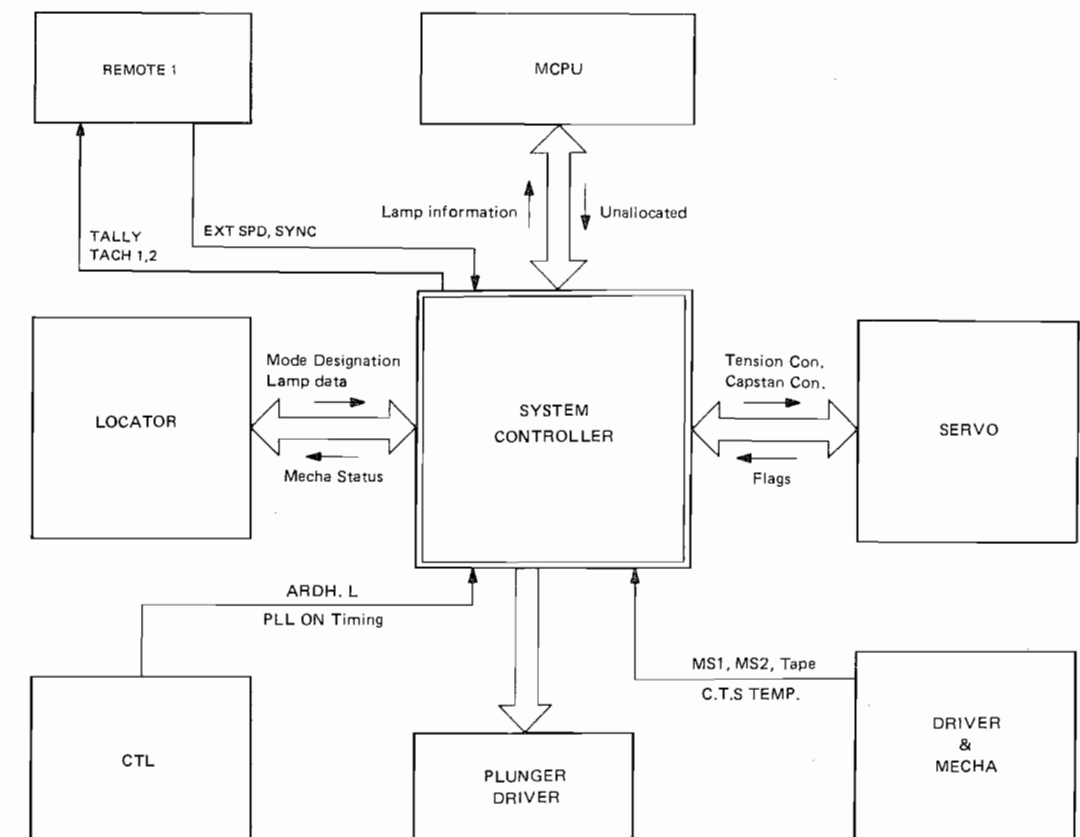


Fig. 2-2. SYSTEM-CONTROLLER inputs/outputs

(4) System-Controller-Locator Interface Circuit



- (1) CPU Assembly
- (2) Oscillator Circuit
- (3) Capstan-Tape Slip Detecting Circuit
- (4) System-Controller-Locator Interface Circuit
- (5) System-Controller-MCPU Interface Circuit
- (6) System-Controller-Servo Interface Circuit
- (7) Plunger Control Circuit
- (8) Capstan Speed Zero Detection Circuit
- (8)* Timer Roller Speed Zero Detection Circuit
- (9) Mecha Flag Input Interface Circuit
- (10) Error Display Circuit
- (11) 10msec Timing Generator & Capstan Speed Detection
- (12) Remote-1 Interface Circuit
(TALLY, TACH-1, 2, EXT SPD, and SYNC Commands)
- (13) Head Timer Driving Circuit
- (14) Motor Power ON/OFF Circuit

(1) CPU Assembly

CPU: Z80A
ROM: Intel 2732 equivalent x 2 (8Kbytes max.)
RAM: C-MOS MSM5128-12K x 1 (8 x 2048 bits)

(2) Oscillator Circuit

Using a 5 MHz crystal, this circuit serves not only as a 2.5 MHz clock for the CPU, but also as a clock for the Slip Detecting Circuit, Z-80CTC (Timer LSI) and Z-80PIO.

(3) Slip Detection Circuit

When an unbalance occurs in the tape tension, the tape sometimes slips along the capstan. This circuit is designed to detect that slip and correct the unbalance in the tape tension.

The circuit monitors the ratio of pulse numbers between FG and Timer FG.

(11) Error Display Circuit

8 LEDs are provided on the SYSTEM-CONTROLLER Board as an Error Display. These display a pattern depending on the error detected by the self-diagnostic program.

(12) 10msec Timing Generator & Capstan Speed Detector

Generates 10msec timing using a Z80 CTC. With this timing, it supplies interrupts to the CPU to execute the following routines.

- 1) Sampling output of Slip Servo
- 2) Clearing of the capstan speed detection counter
- 3) Confirmation of Servo Clock frequency
- 4) Self-Diagnostic Programs such as TD check, Low Tension Check, etc
- 5) Others

(13) Remote-1 Interface Circuit

This consists of the Tally Output Circuit, TACH Pulse Output Circuit, and EXT SPD/SYNC Command Input Circuit.

(14) Head Timer Driving Circuit

This circuit supplies 5V to a mercury timer for measuring the PLAY execution time.

(15) Motor Power ON/OFF Circuit

This circuit turns the power of capstan and reel drivers on or off.

The System-Controller-Locator Interface Circuit is connected to the Locator bus.

Both System-Controller $\rightarrow$ Locator and Locator $\rightarrow$ System-Controller have 4-byte registers. After writing data in the register, it supplies an interrupt. The side having received information returns Acknowledge.

(5) System-Controller-MCPU Interface

The System-Controller-MCPU Interface is connected to the MCPU bus. The System-Controller ← MCPU causes hardware to generate flashing on receiving lamp data. The lamp data is rewritten periodically, and the MCPU scans it at a fixed interval. The MCPU → System-Controller has a 1-byte register, content unallocated.

(6) System-Controller-Servo Interface

An 8 bit bi-directional bus between SYSTEM-CONTROLLER and SERVO is provided and there is a register on the SERVO Circuit Board. Since the SYSTEM-CONTROLLER SERVO INTERFACE which controls the capstan speed, acceleration/deceleration rate, tape tension servo mode (speed servo or phase servo) is critically important for mechanism control, there is a self-diagnostic program for checking the state of the bus.

(7) Plunger Control Circuit

SYSTEM-CONTROLLER controls, through drivers, the GEARED MOTOR (the Tension Regulator moving motor) and the reel motor brake and shift roller plungers. 8 LEDs are also provided on the SYSTEM-CONTROLLER.

(8) Capstan Speed Zero Detection Circuit

This detects from the Capstan FG when the rotational speed of the motor nears stop. This ZERO signal causes the switching over of the servo.

(9) Timer Roller Speed Zero Detection Circuit

This detects from the Timer FG when the rotational speed of the Timer Roller becomes less than normal speed.

(10) Mecha and Flag Input Interface Circuit

Inputs the various mecha status flags directly into the
SYSTEM-CONTROLLER I/O.

Capstan Motor Temperature Abnormal (CTEMP)
Take-Up Reel Temperature Abnormal (TTEMP)
Supply Reel Temperature Abnormal (STEMP)
Shut-Off (Tape)
MS1, MS2 (Detection of Tension Regulator Position)
AREA DET H, L (Capstan speed within $\pm 3\%$ in FWD mode)

2-1-4. System-Controller Software

After POWER ON RESET following POWER ON, SYSTEM-CONTROLLER initiates and executes Self-Diagnostic Program I. In the program, it executes a bus check between SYSTEM-CONTROLLER and Servo, a RAM check and $\pm 15V$ system check, and if the result is normal, it turns the Servo ON. In case of any abnormality, it is displayed on LEDs according to the abnormality mode display.

After SERVO ON, it executes the following:

- SERVO CONTROLLER
- SYSTEM CONTROLLER LOCATOR INTERFACE
- LAMP CONTROL

Then, it executes Self-Diagnostic Program II.

SERVO CONTROL is designed to control the servo system, that is, capstan speed, capstan acceleration and deceleration rate, tape tension and plunger towards the target status decided by INT2 described later.

SYSTEM-CONTROLLER → LOCATOR INTERFACE returns the mecha status to Locator

FUNCTION KEY LAMP CONTROL decides the ON/OFF lamp conditions (including flashing) from the mecha status and the lamp data received from Locator, and sends into to MCPU.

Self-Diagnostic Program II checks the Electric System ($\pm 15V$), Servo Lock, Speed Over, Arm Lock, Motor Temperature Abnormal, Tape Tension Abnormal and Capstan Speed Over, and it shuts off when any abnormality is detected. In this case, the abnormality is displayed on LEDs according to the abnormality mode. If the check result is normal, the main loop is repeated.

Interrupts to SYSTEM-CONTROLLER can be classified into 3 systems. An Interrupt from Locator is accepted by Z80PIO and is supplied to the CPU in MODE2. A decision is made as to whether the mode designation is of correct format, and if correct, the target mecha status register is updated.

If there is any abnormality in format, it is neglected. (INT2) At the same time, Interrupts are supplied to the CPU by the Z80CTC on SYSTEM-CONTROLLER's board at intervals of 10msec and 3.3msec, and using a 10msec timing, each of the following routines is executed. (INT1)

- SPDET
- FRMDET
- SLIPSV
- TDCHCK
- TRCHCK
- LTEN
- RCMASK

EXT SPD and SYNC commands are input from Remote 1 using a 3.3msec timing, and software processing to prevent chattering is performed. A decision then is made for the target status.

SPDET detects the capstan speed.

FRMDET checks whether Servo Lock is input correctly, and if the result is good, it puts up an OK flag.

SLIPSV controls tape tension according to the slip information from the Slip Detector. (INT1)

TDCHCK checks the turning direction of the reel, capstan, and timer roller.

TRCHCK checks whether the tape is threaded on the tension regulator.

LTEN checks abnormal lowering of tape tension.

RCMASK stops the reel-runaway detector using the transient of the shift roller.

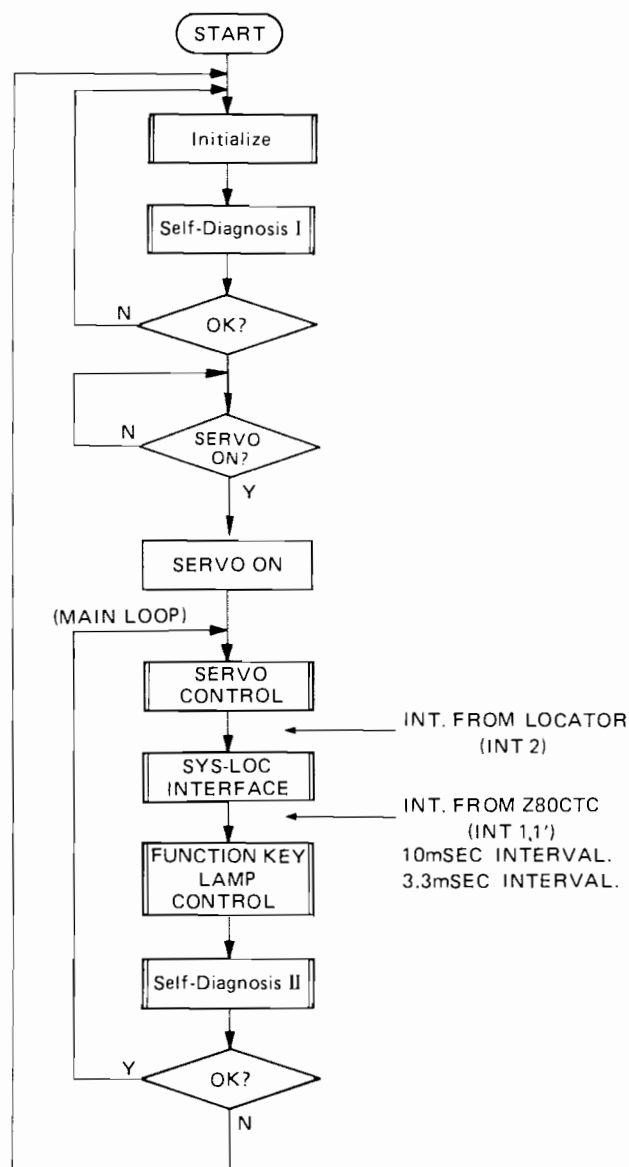


Fig. 2-4. SYSTEM-CONTROL main flow chart

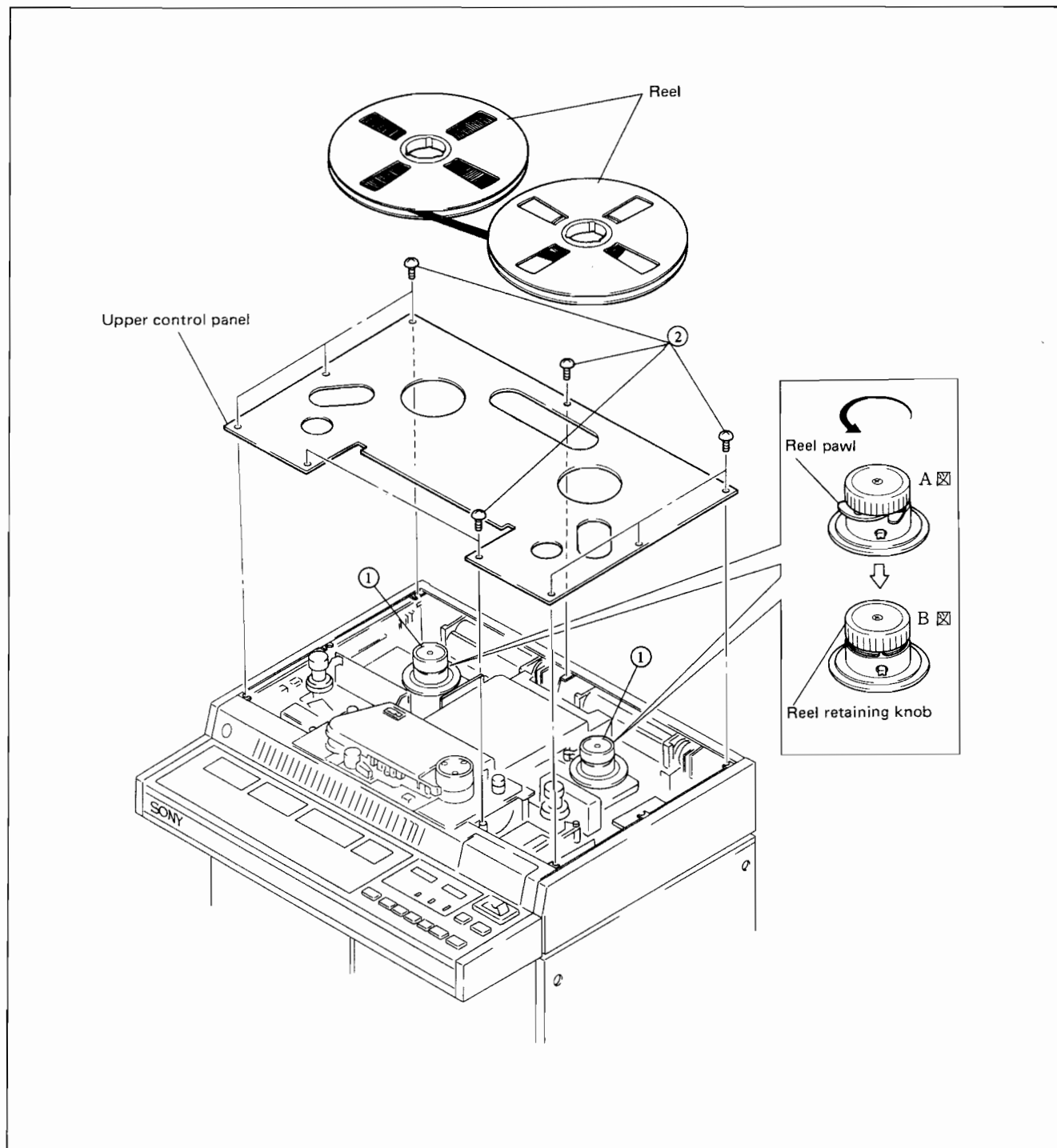
SECTION 3

PREPARATION FOR ADJUSTMENT AND REPLACEMENT

3-3. REMOVING

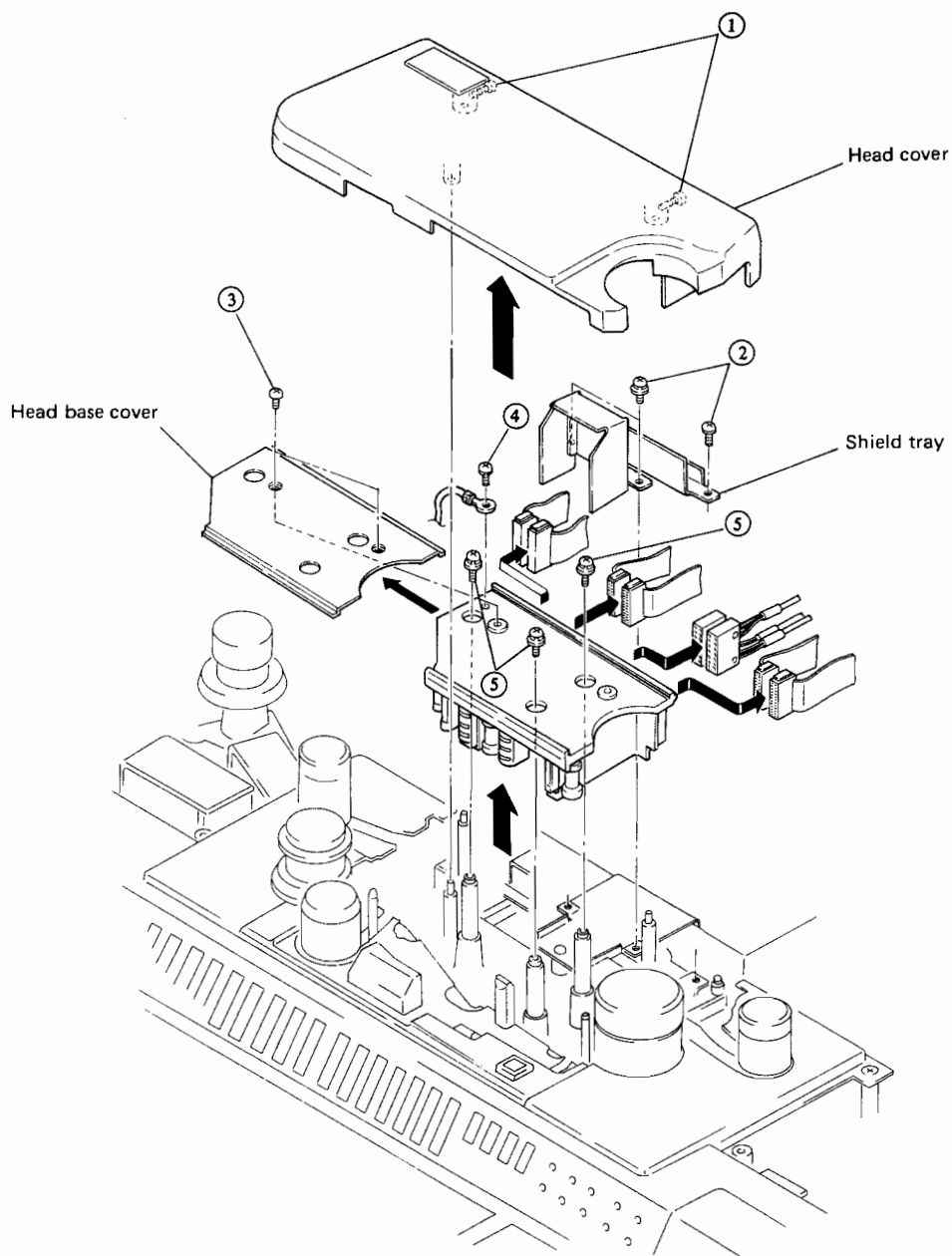
3-3-1. Removing the Upper Control Panel

- ① Turn the reel retaining knob in the direction shown by the arrow until the reel pawl comes from the position in Fig. A to the position in Fig. B and remove the reel.
- ② Unfasten the 9 screws and remove the control panel. Make sure that the dress screw is not unfastened.



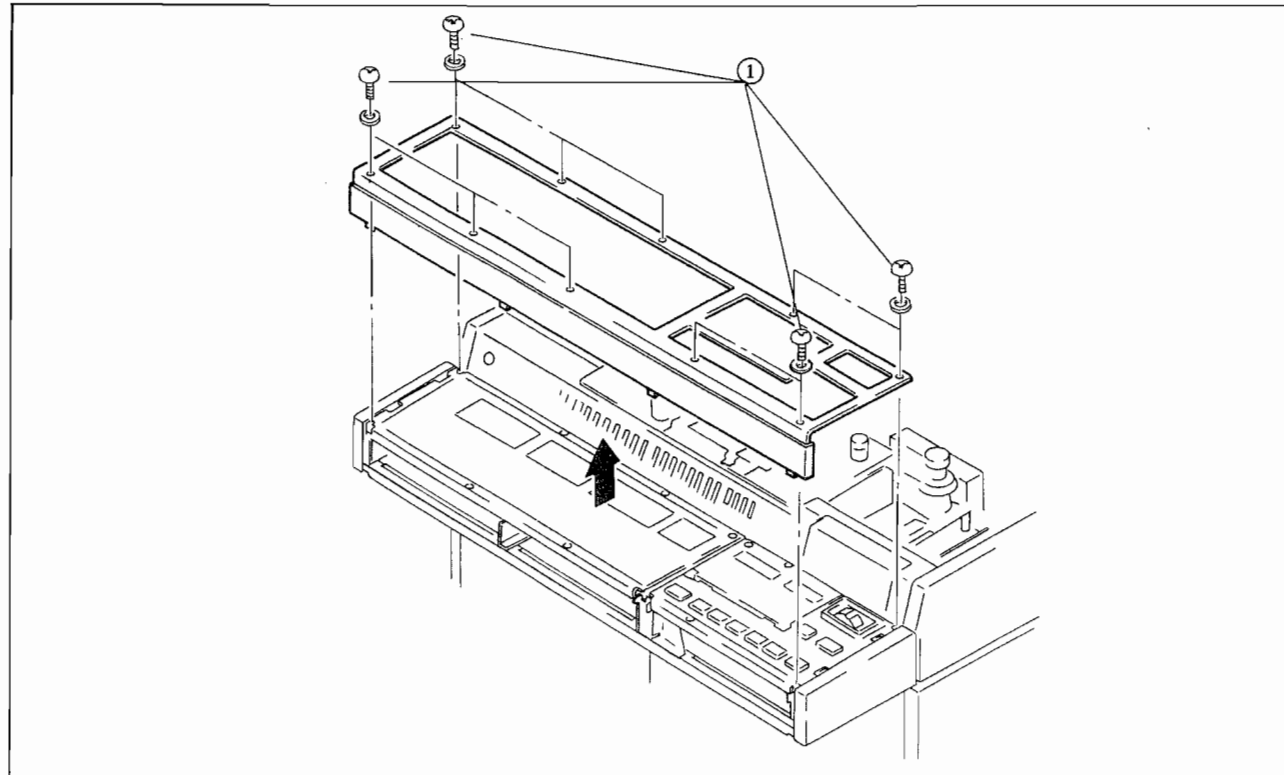
3-3-2. Removing the Head Block

- ① Untighten the 2 screws and remove the head cover.
- ② Unfasten the 3 screws and remove the shield tray.
- ③ Unfasten the 2 screws and slide it to pull out the head base cover.
- ④ Unfasten the screw and remove the earth lead wire. Pull out the 8 connectors.
- ⑤ Unfasten the 3 screws and remove the head block.

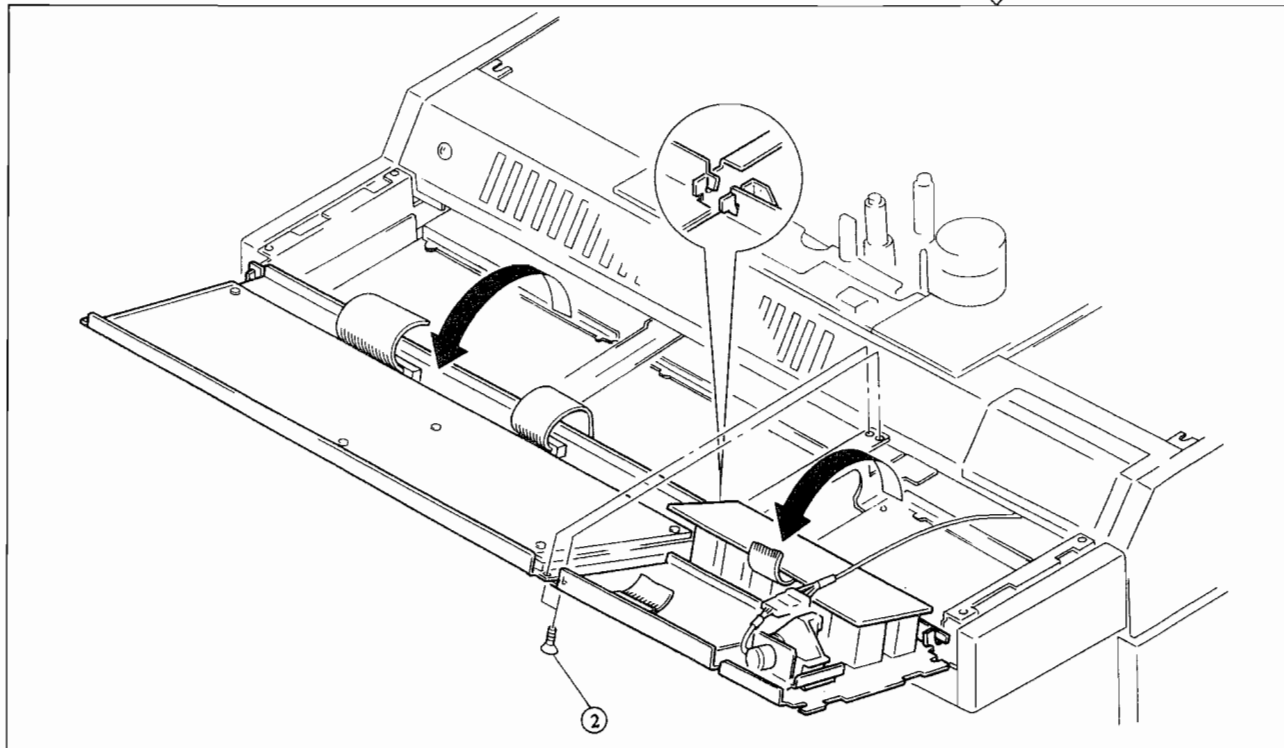


3-3-3. Removing the KEYBOARD and METER Panel

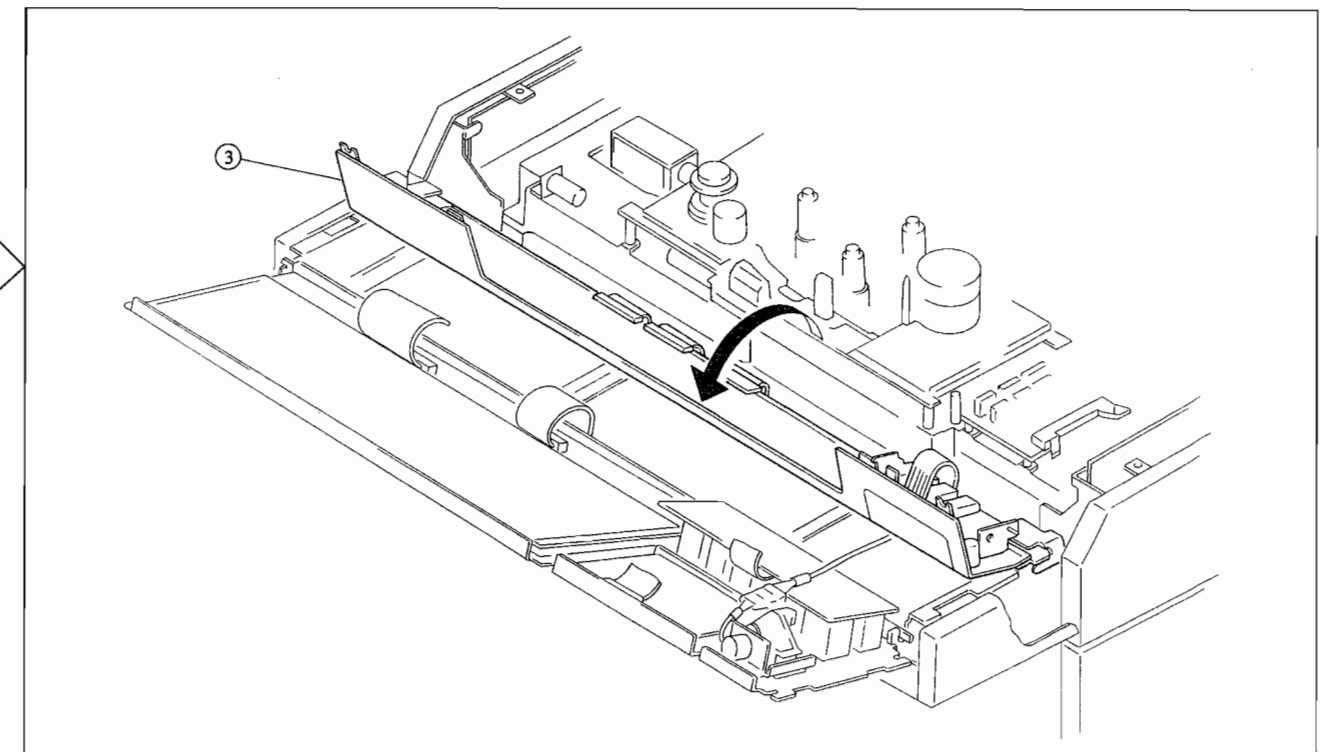
- ① Unfasten the 10 screws and remove the keyboard panel.



- ② Unfasten the 2 screws and tilt the keyboard in the direction of the arrow.

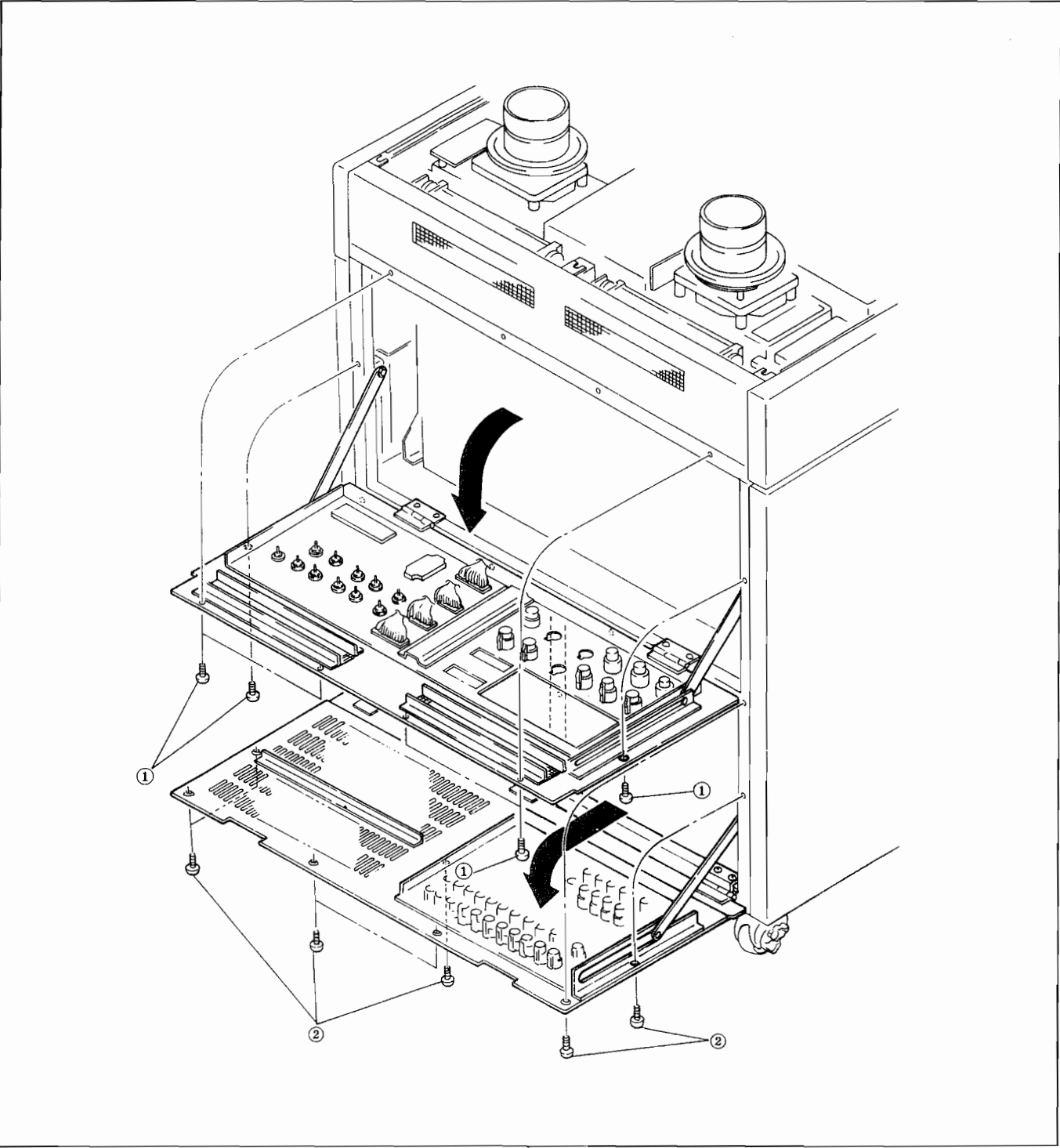


- ③ Tilt the meter panel in the direction of the arrow with the keyboard in the open position.



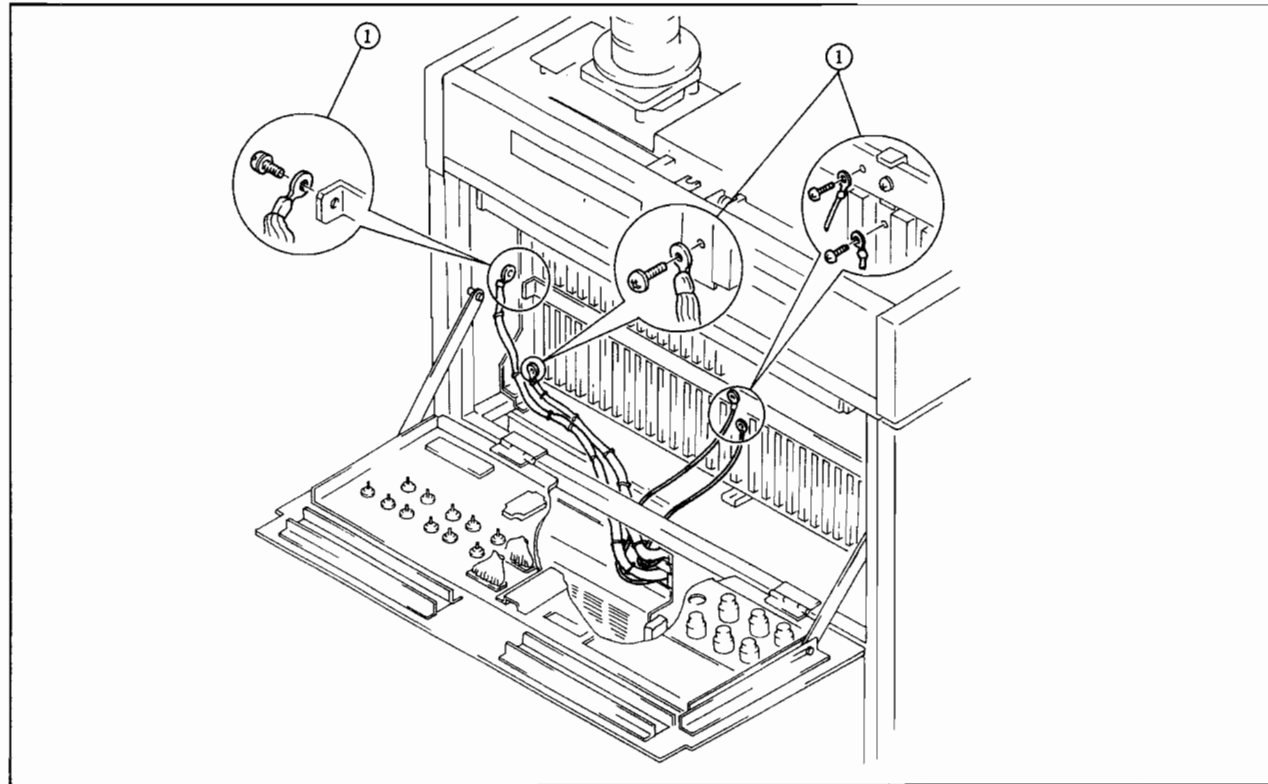
3-3-4. Removing the D.A. Panel Frame

- ① Unfasten the 6 screws and tilt the D panel frame in the direction of the arrow.
- ② Unfasten the 7 screws and tilt the A panel frame in the direction of the arrow.

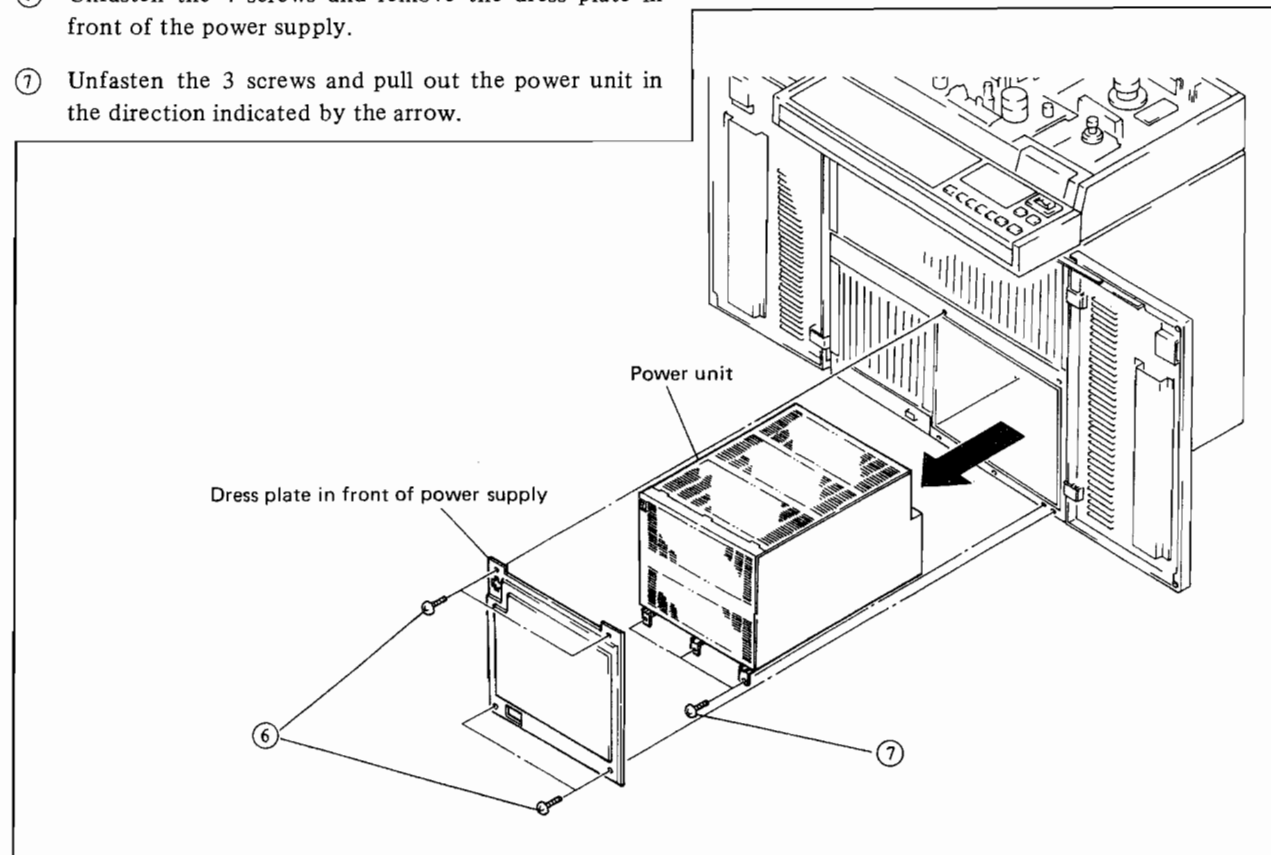


3-3-5. Removing the Power Block

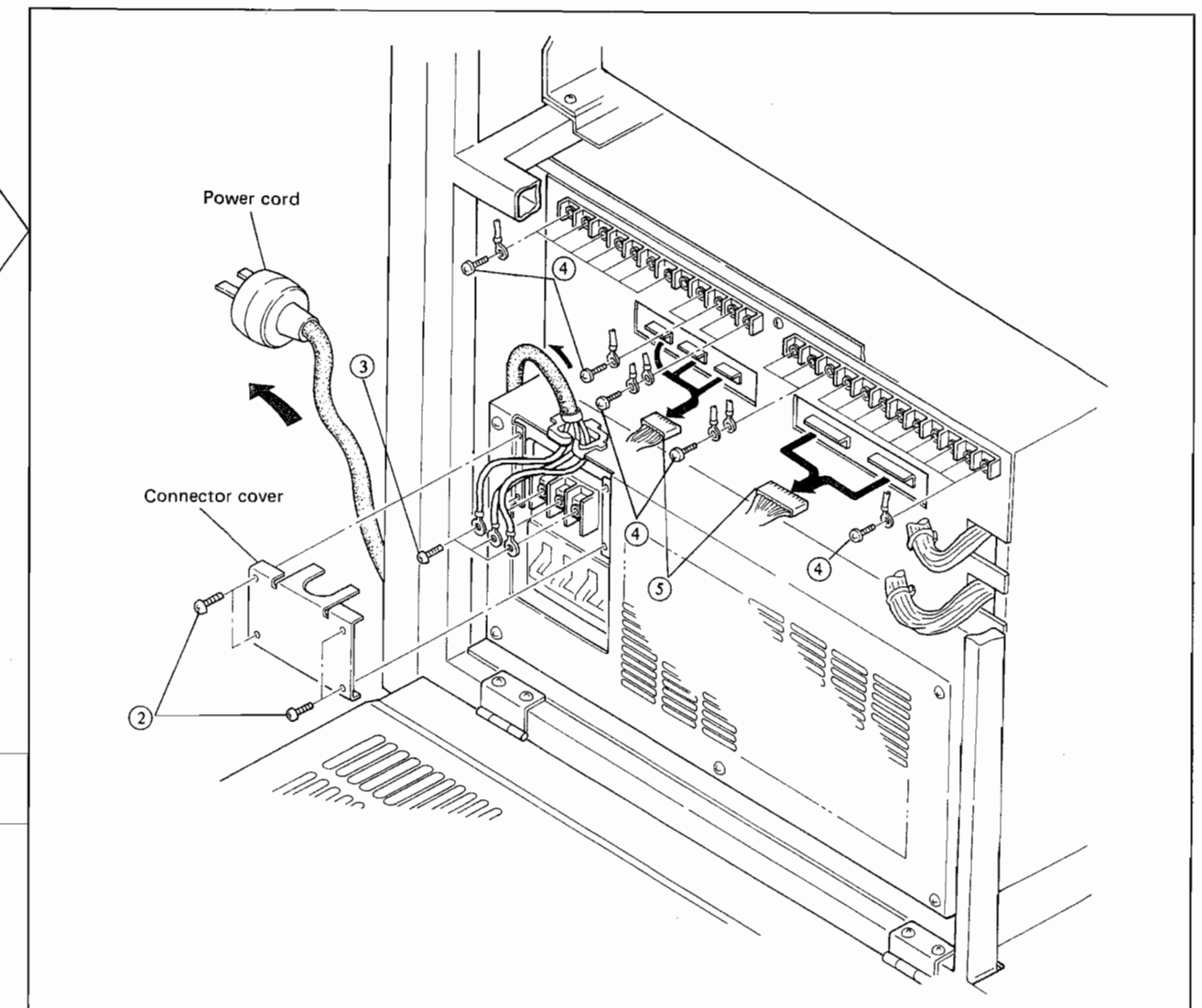
- ① Unfasten the 4 screws and remove the 4 pressure contact terminals (2 large, 2 small).



- ⑥ Unfasten the 4 screws and remove the dress plate in front of the power supply.
- ⑦ Unfasten the 3 screws and pull out the power unit in the direction indicated by the arrow.

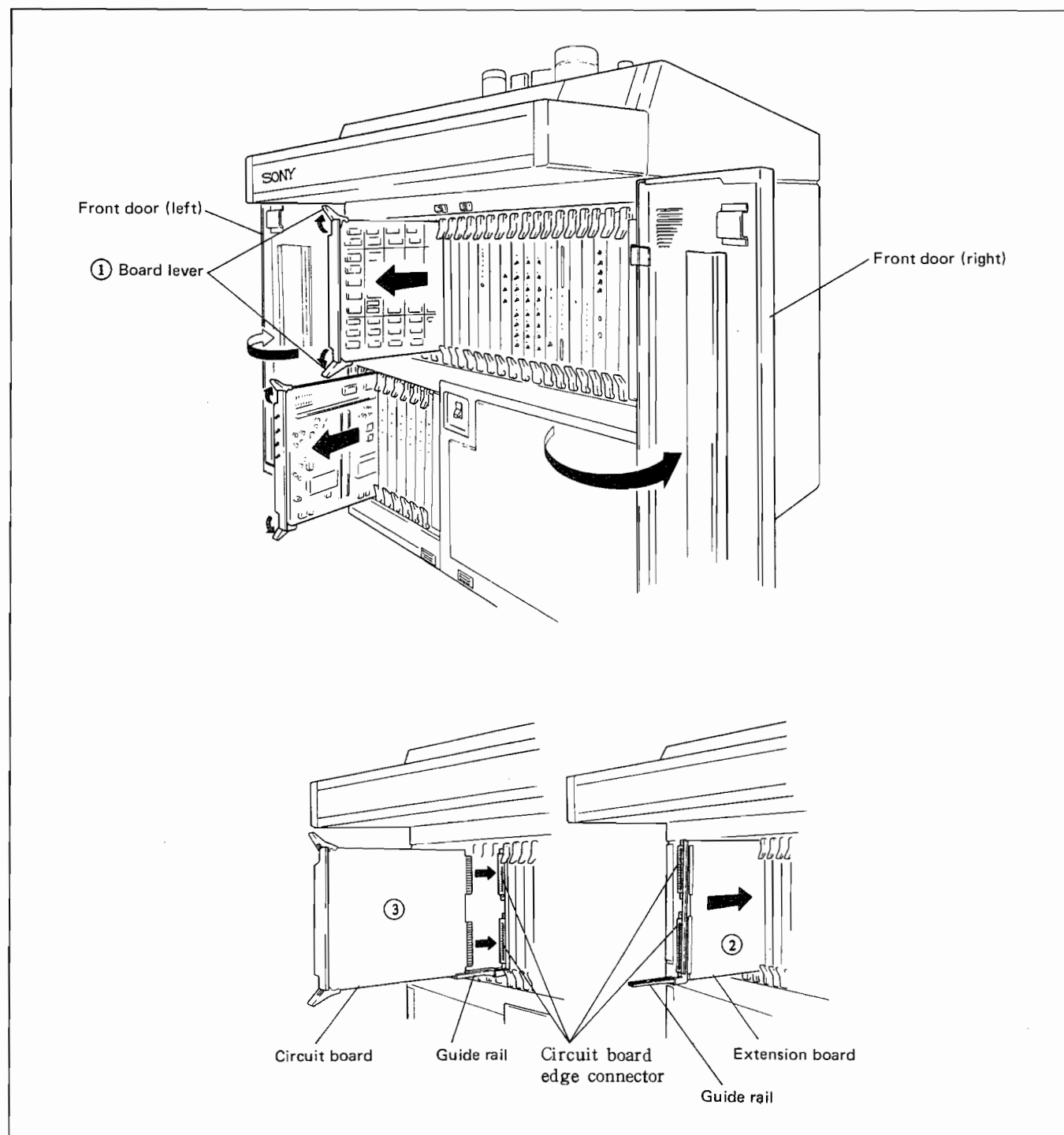


- ② Unfasten the 4 screws and remove the connector cover.
- ③ Unfasten the 3 screws and remove the 3 pressure contact terminals. Then pull out the power cord in the direction indicated by the arrow.
- ④ Unfasten the 23 screws and remove the 28 pressure contact terminals.
- ⑤ Remove the 5 connectors.



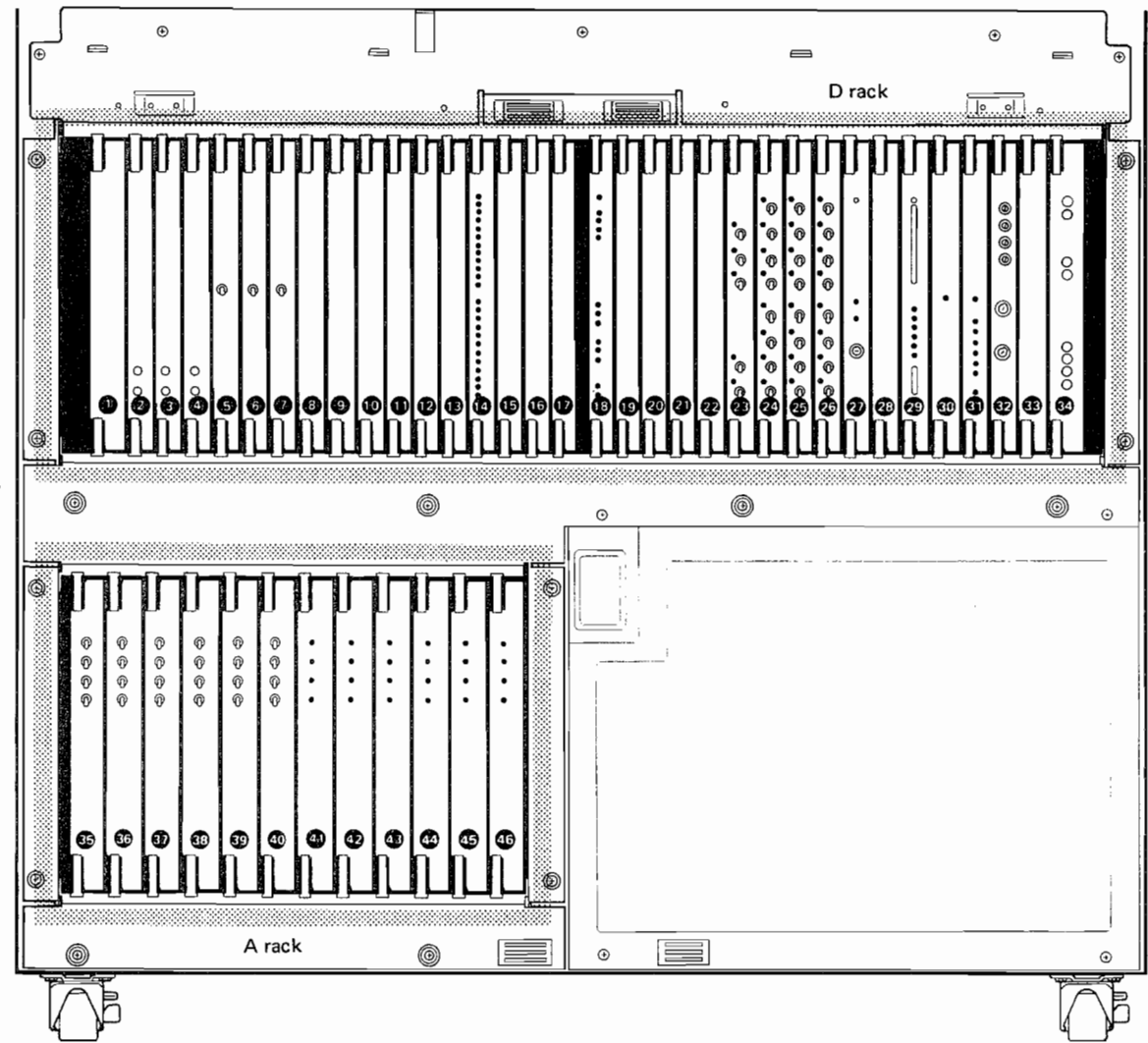
3-4. USING THE EXTENSION BOARD FOR ADJUSTMENTS AND CHECKS

- ① Open the front double doors, open the two board levers upward and downward, and pull out the board in the direction of the arrow.
- ② After pulling out a circuit board, insert the extension board in the direction of the arrow.
- ③ Insert the circuit board into the edge connector in the direction of the arrow.



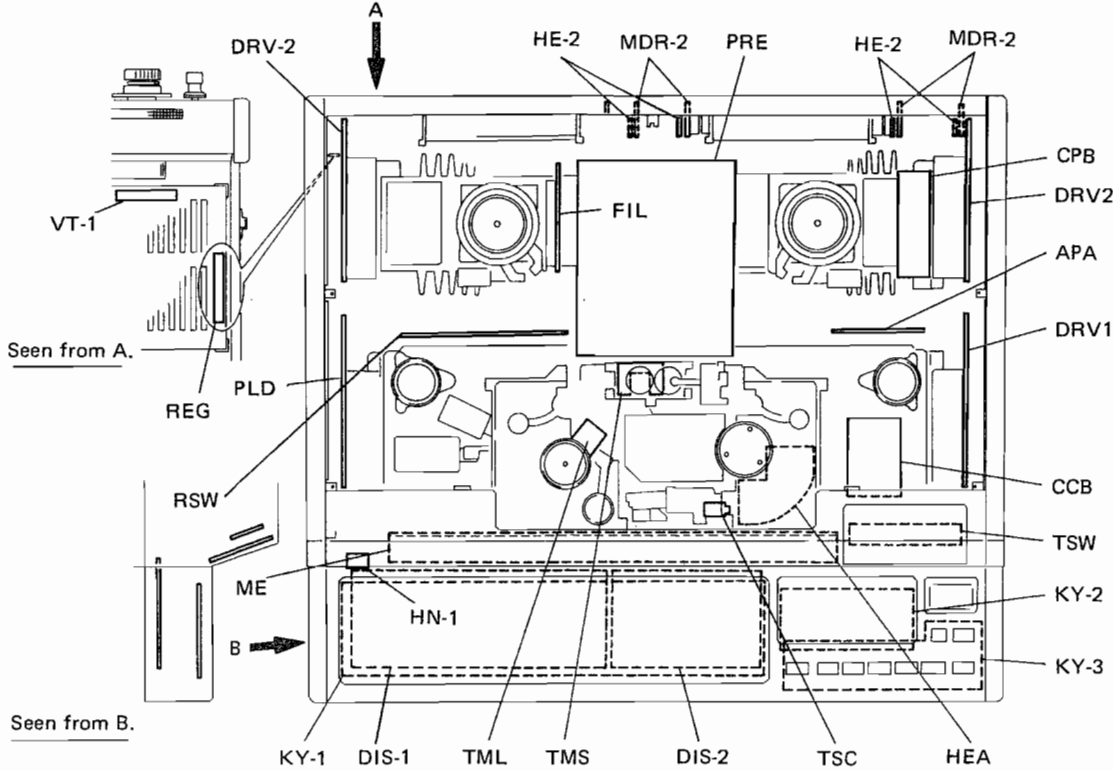
3-5. BOARD DISTRIBUTION DIAGRAM

< D and A racks >



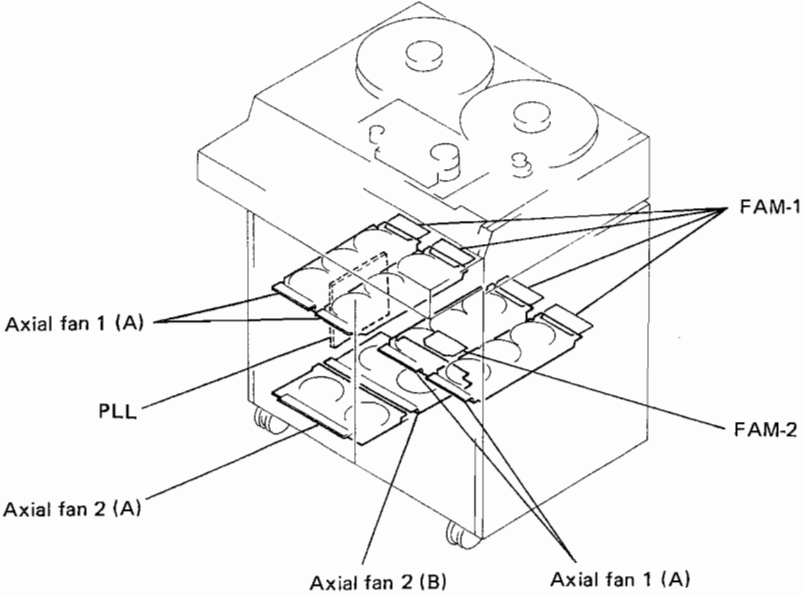
① REC BOARD	⑫ SEP BOARD	⑳ EDT B BOARD	㉓ ARP BOARD
② ENC BOARD	⑬ SEP BOARD	㉔ DIN-1 BOARD	㉕ A/D-1 BOARD
③ ENC BOARD	⑭ TBC BOARD	㉕ DIN-2 BOARD	㉖ A/D-2 BOARD
④ ENC BOARD	⑮ DEC BOARD	㉖ DIN-3 BOARD	㉗ A/D-3 BOARD
⑤ DET-1 BOARD	⑯ DEC BOARD	㉗ MCU BOARD	㉘ A/D-4 BOARD
⑥ DET-2 BOARD	⑰ DEC BOARD	㉘ EIO BOARD	㉙ A/D-5 BOARD
⑦ DET-3 BOARD	⑱ DCC BOARD	㉙ CTL BOARD	㉚ A/D-6 BOARD
⑧ SEP BOARD	⑲	㉚ LOC BOARD	㉛ D/A-1 BOARD
⑨ SEP BOARD	⑳	㉛ SYS BOARD	㉜ D/A-2 BOARD
⑩ SEP BOARD	㉑ CLK BOARD	㉜ SRVO BOARD	㉝ D/A-3 BOARD
⑪ SEP BOARD	㉒ EDT A BOARD	㉝ TCT BOARD	㉞ D/A-4 BOARD

< Upper control panel >

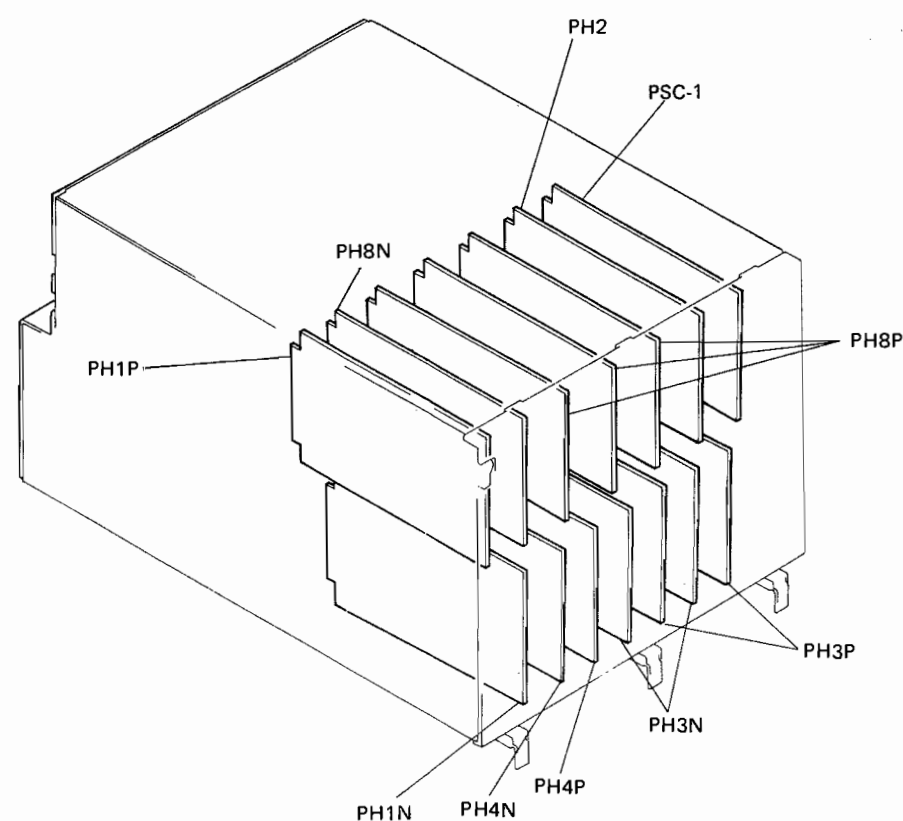


< Axial fan >

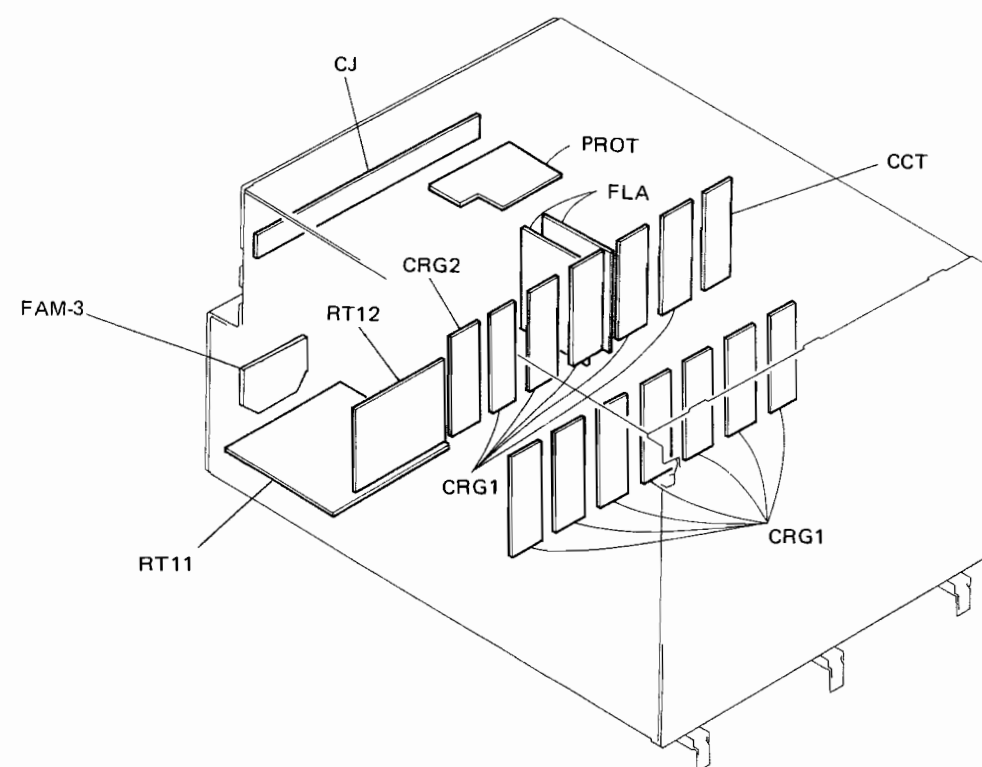
- ④⑤ D/A-5 BOARD
- ④⑥ D/A-6 BOARD



Power Unit (1)



Power Unit (2)

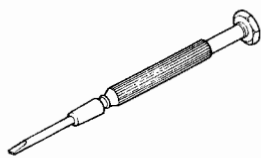
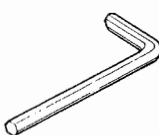
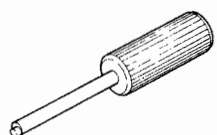
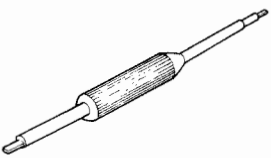
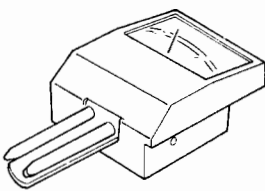
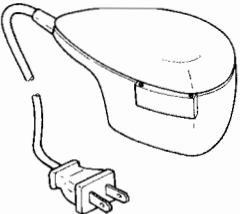
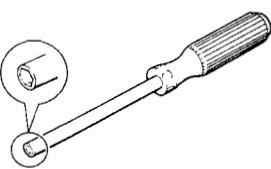
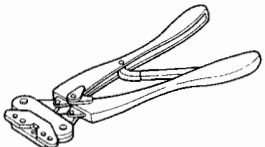
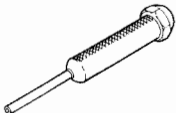
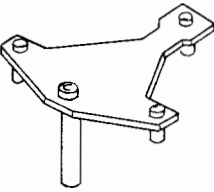
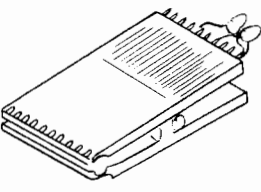
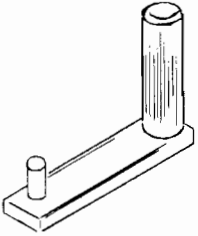
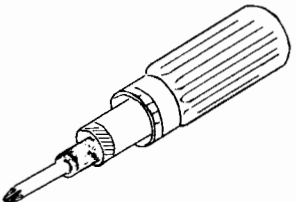
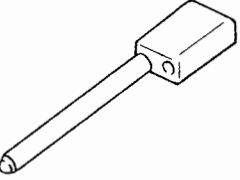
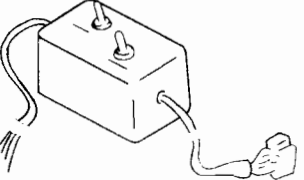
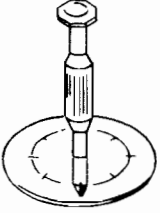
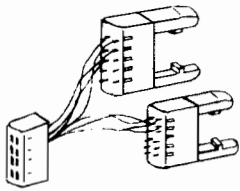
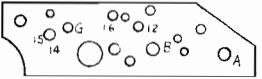
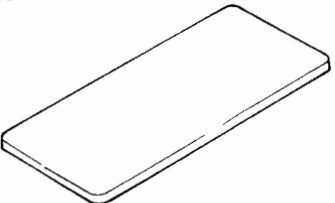


3-6 SERVICE TOOLS

Ref. No.	Name	Part Code	Remarks
J1	Precision Screwdriver	7-721-051-10	Screwdriver Set Following Blade Size: 0.8 mm No. 1, 1.4 mm No. 2, 2 mm No. 3, 2.4 mm No. 4, 2.9 mm No. 5, 3.8 mm No. 6
J2	L-shaped Hexagonal Wrench	7-700-736-00	Set of 12 hexagonal wrenches with the following socket sizes: 1.27 mm, 1.4 mm, 1.5 mm, 1.58 mm, 2 mm, 2.5 mm, 3 mm, 4 mm, 5 mm, 6 mm, 8 mm, 10 mm
J3	Eccentric Screwdriver	J-6103-100-A	For head spacing adjustment
J4	Alignment Tool	7-700-733-02	For front-end alignment
J5	Tentelometer (T2-H12-2)	J-6041-680-A	For tape tension adjustment
J6	Head Eraser	○	VCR211 Made by NORTRONICS Inc. (USA)
Tools for attaching or detaching the 104P-remote control terminal			
J7	Nut Screwdriver	○	811262-2
J8	Control Tool	○	45099 Made by AMP Inc.
J9	Push-pull Tool	○	305183-J

J10	Tension regulator, Potentiometer Adj, Jig	J-6103-820-A	For position adjustment
J11	Low tension Jig 1	J-6103-840-A	Detecting position
J12	Low tension Jig 2	J-6103-430-A	For position adjustment
J13	Screwdriver with torque limiter	J-6103-860-A	+ 4mm
J14	Bending Jig	J-6103-550-A	For tape shifter adjustment
J15	Analog REC AMP Jig	J-6103-480-A	For analog head adjustment
J16	Precision screwdriver with protractor	J-6103-800-A	For head adjustment
J17	Analog extension cable	J-6103-850-A	For analog head adjustment
J18	Indication plate	J-6103-630-A	For head adjustment
J19	Transparent tape	J-6103-540-A	For azimuth adjustment
J20	Parallel plate	J-6086-570-A	For head slant adjustment

○ Commercially available to local distributor
(not available from repair parts center)

J1 	J2 	J3 
J4 	J5 	J6 
J7 	J8 	J9 
J10 	J11 	J12 
J13 	J14 	J15 
J16 	J17 	J18 
J19 	J20 	

SECTION 5 MECHANISM ADJUSTMENT

5-1. Adjustment of tape tension

5-1-1. Tension servo

- | | | |
|--|----------------------|---|
| (1) Positioning of the tension detection potentiometer | Tension servo output | Voltmeter, Positioning tool |
| (2) Low tension detection adjustment (SRVO board) | Tension servo output | Voltmeter, Low tension detection releasing tool |

5-1-2. Adjustment of tape tension

- | | | |
|---|--------------|--------------------------|
| (1) Adjustment to 0 voltage | Tape tension | Blank tape, tentelometer |
| (2) Adjustment of the offset tension of the spring (200g) of the tension regulation link. | Tape tension | Blank tape, tentelometer |
| (3) Adjustment of the tape tension | Tape tension | Blank tape, tentelometer |
| | Tape tension | Blank tape, tentelometer |
| | Tape tension | Blank tape, tentelometer |
| | Tape tension | Blank tape, tentelometer |
| | Tape tension | Blank tape, tentelometer |

5-2. Adjustment of reel table level

5-2-1. Adjustment of T-side reel table level

Visual check

Blank tape

5-2-2. Adjustment of S-side reel table level

Visual check

Blank tape

5-2-3. Brake Torque Adjustment

Visual check

Torque adjusting jig
Tension gauge

5-3. Position adjustment of tape shifter and shift roller

5-3-1. Adjustment of the 1st retracting position of shift roller

Visual check

Adjusting jig

5-3-2. Adjustment of the 2nd retracting position of shift roller

Visual check

Adjusting jig

5-3-3. Adjustment of shift roller brake damper

Visual check

5-3-4. Adjustment of tape shifter position

Visual check

5-4. Adjustment of shut-off position

5-4-1. Adjustment of photo interrupter position

Visual check

5-5. Adjustment of head front shield

5-5-1. Adjustment of head front shield position

Visual check

Jig

5-6. Replacement of HBU

5-6-1. Replacement of Heads

(1) Removal of HBU

(2) Service tools and jigs

(3) Replacement of Heads

(D/AD, D/S•REC, D/PB, AE, ARP)

Visual check

Clock screwdriver
Parallel plate
Transparent type for tentative azimuth adjustment
Screw display plate
L-type uprench

(4) Setting of HBU

(5) Adjusting methods

<1> Azimuth adjustment

- 1) Azimuth adjustment of D/REC head (2)
- 2) Azimuth adjustment of D/PB head
- 3) Azimuth adjustment of AE head
- 4) Azimuth adjustment of ARP head

<2> Head contact check

- 1) Check D/AD, D/S-REC, and D/PB head contacts
- 2) Check ARP head contact
- 3) Check AE head contact

Contact adjustment tape
A-azimuth adjustment tape

<3> Tape running adjustment (FWD)

- 1) Timer roller height adjustment
- 2) S-tension roller height adjustment
- 3) S-guide roller height adjustment
- 4) T-tension roller height adjustment
- 5) T-guide roller height adjustment
- 6) Reel mount height adjustment

Visual check
Visual check
Visual check
Visual check
Visual check
Visual check

DET-1 board, AC voltmeter
Tape path adjustment tape
Tape path adjustment tape
Tape path adjustment tape
Tape path adjustment tape
Tape path adjustment tape
L-type uprench

<4> Tape running adjustment (FF and REW)

- 1) Confirmation

Visual check

Tape path adjustment tape

<5> Head Adjustment

- 1) Head distance adjustment

1. Adjustment of distance D/AD-REC D/PB
2. Adjustment of distance D/PB D/S-REC

Eccentric screwdriver
Adjustment tape

- 2) Development of each head

1. D head measurement
2. AE-ARP (TCT) head measurement
3. Calculation of correction amount of each head height

Visual check

REC amp. jig

- 3) Fine-adjustment of head height and azimuth
- 4) Check of head distance adjustment
- 5) Check of head height and azimuth adjustment
(For readjustment of head distance)

Visual check

Use a fine-adjusting screwdrive

<6> REC/PB

(6) Confirmation and Check

- 1) Tape running check
- 2) Tape shlip
- 3) Wow of tape during record/playback operation
- 4) Error rate check
- 5) Punch input/output

Visual check
Visual check

Run the tape
Run the tape

5-6-2. Replacement of Blocks

- (1) Removal of HBU
- (2) Setting of HBU
- (3) Tools and jigs
- (4) Adjusting methods
 1. Tape running adjustment (FWD)
 2. Tape running adjustment (FF and REW)
 3. Confirmation of head adjustment
 4. REC/PB adjustment

5-1. ADJUSTMENT OF TAPE TENSION

5-1-1. Tension Servo

(1) Positioning of the Tension Detection Potentiometer
T-side (Within the parenthesis is the S-side.)

- Fix the positioning tool to the removed tension arm ass'y T (S). See Fig. 5-1-1.

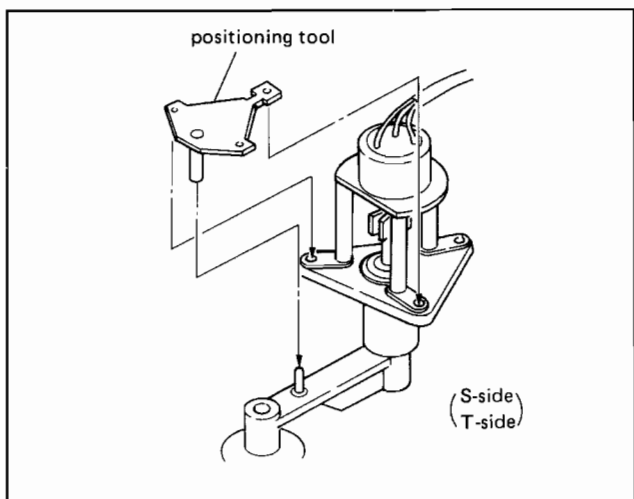


Fig. 5-1-1

- Connect the $\oplus$ terminal of the voltmeter to TP101 (TP105) on the SRVO board and the $\ominus$ terminal to TP104 (TP108). See Fig. 5-1-2.

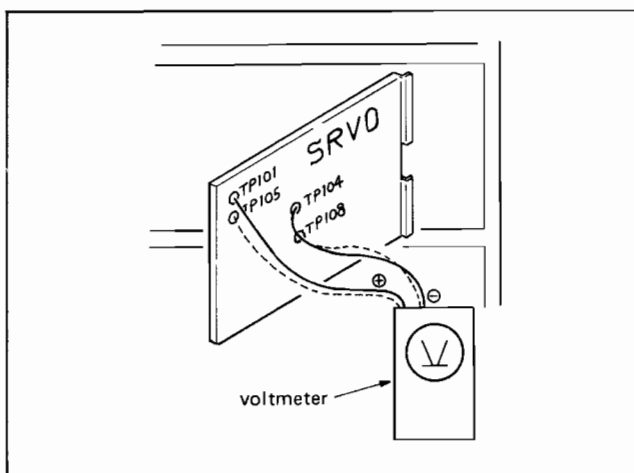


Fig. 5-1-2

- Turn the power SW on.
- Turn the coupler position of the tension arm ass'y so that the voltmeter indicates 0 voltage (allowance $\pm 10\text{mV}$) and fix with a screw.
- Remove the positioning tool. Turn the tension lever clockwise for an angle of 30° from 0 point and confirm that the voltmeter indicates minus, and also turn it counterclockwise for an angle of 30° and confirm that the voltmeter indicates plus. (See Fig. 5-1-3)

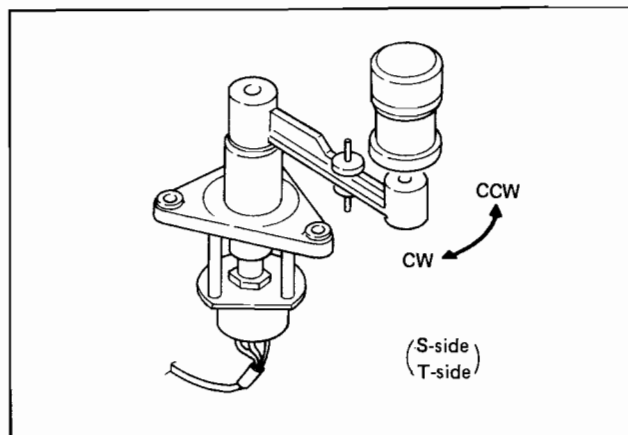


Fig. 5-1-3.

If the voltmeter indicates reversely, re-adjust until the correct polarity is obtained.
(Shift the coupler for an angle of 180° .)

<Jigs and tools>

1. positioning tool
2. voltmeter (or oscilloscope)
3. D-rack extension board
4. hexagonal wrench

(2) Low tension detection adjustment (SRVO board)

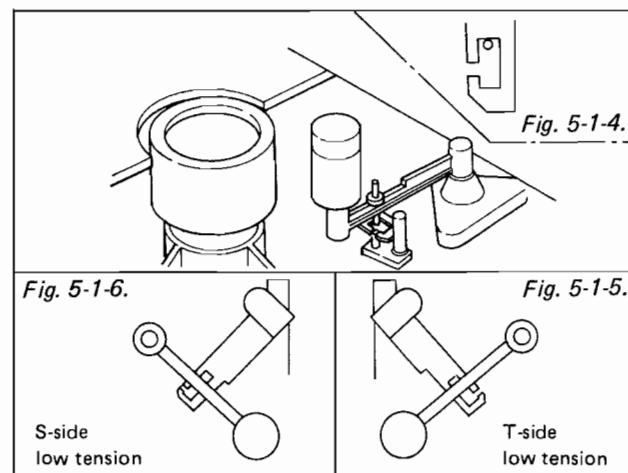


Fig. 5-1-6.

Fig. 5-1-5.

Preparation

- Set the tension screw off.;
Turn off the "TEN SRV SW" on the SRVO board.
- Release the END OF TAPE (E.O.T.) sensor.;
Disconnect CN104 from the CCB board.
- Release low tension detection.;
Connect the low tension detection releasing tool to IC35 on the SRVO board.

Adjustment

- Fix the low tension detection tool to the T-side (S-side) tension arm.
- Adjust RV108 (RV109) on the SRVO board so that (a) the T-side (S-side) LED of the low tension detection release tool lights up when the low tension positioning tool is fixed and (b) goes off when not fixed.
 - { T-side LED yellow
 - { S-side LED green

Confirmation

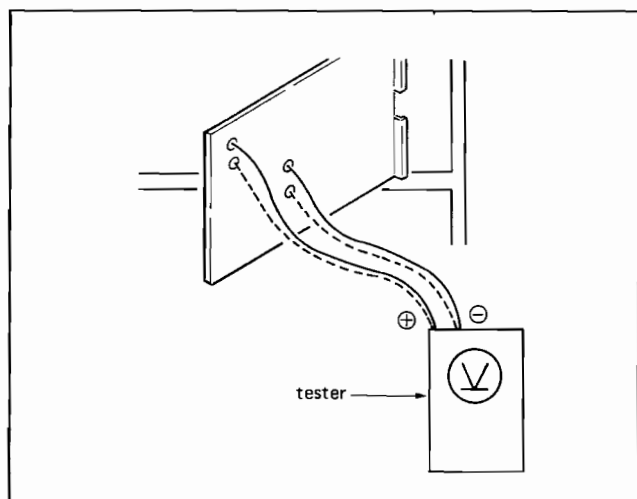
Confirm that when the low tension detection release tool is removed in load mode the tension regulation arm becomes shut off and so load mode is released.

5-1-2. Adjustment of the Tension

- (1) Adjustment to 0 Voltage
 - Load a tape.
 - Adjust the voltage to 0V ($\pm 10\text{mV}$) with the S.F. trimmer on the SRVO board.

connection:

SH: TP105 to $\oplus$, TP108 to $\ominus$
 TH: TP101 to $\oplus$, TP104 to $\ominus$



- (2) Adjustment of the Offset Tension of the Spring (200g) of the Tension Regulation Link

- Adjustment of the tension on the T side (T, H) Forward the tape by the shuttle slowly as in the play mode. Adjust the tension on the T side to $200\text{gr} \pm 5\text{gr}$ by using the tension adjustment screw. (Fig 5-2-2 and 5-2-3)
- Adjustment of the tension on the S side (S, H) Rewind the tape by the shuttle slowly as in the play mode. Adjust the tension on the S side to $200\text{gr} \pm 5\text{gr}$ by using the tension adjustment screw. After the adjustment is finished, fix with the lock screw. (Fig. 5-2-2 and 5-2-4)

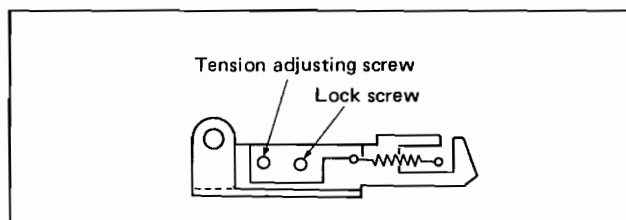


Fig. 5-2-2.

- (3) Adjustment of the Tape Tension
Adjustment of the tape tension in REW mode (Reverse tension)

- Rewind the tape slowly at a speed as in play mode by using a shuttle.
- Adjust the T side tension to $160\text{gr} \pm 5\text{gr}$ with the TL trimmer on the SRVO board.

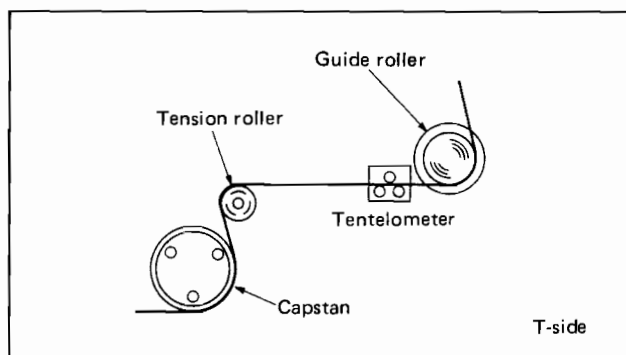


Fig. 5-2-3.

- Adjustment of the tape tension in FF mode (forward tension)

- Forward the tape slowly at a speed as in play mode by using a shuttle.
- Adjust the S side tension to $160\text{gr} \pm 10\text{gr}$ with the SL trimmer on the SRVO board.

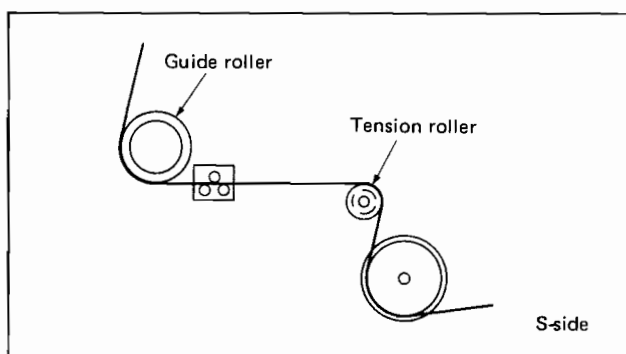


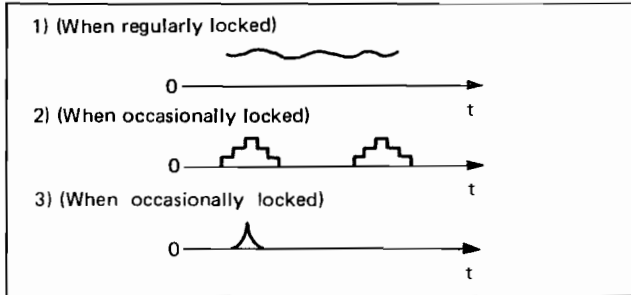
Fig. 5-2-4.

- Adjustment of the tape tension in play mode

- Put the set in play mode, with blank tape.
- Adjust the S side tension to $130\text{gr} \pm 10\text{gr}$ with the SF trimmer on the SRVO board.

5-1-3. Tape Tension Check

- (1) TL check
 - Connect the oscilloscope between TP-1 (slip servo signal) on the SRVO board and GND, set to FF and REW modes, and then check that the slip servo is not constantly locked.



- When rewinding the tape with the 10-inch reel loaded, if the slip servo is instantaneously locked about two or three times at a speed-up time to return to 0V, the function is normal (as shown in 3). If locked several times, the tension should be increased or decreased by 5gr.
- Also, if the slip servo is often locked, readjust in the opposite manner to that described above. Adjust the tension, with looking at the slip servo, not to slip over 10 times when the 10-inch reel tape runs from top to end.

Note: When the setting of tension is completed, check the following:

(For SH, setting value: within $200 \pm 20\text{gr}$)
(For TL/SH, within 0.80 ± 0.05)

- (2) SL check
(Run the tape forward with the 10-inch reel loaded, in the same way as for TL.) When the setting of tension is completed, check the following:
(For TH, setting value: within $200 \pm 20\text{gr}$)
(For SL/TH, within 0.80 ± 0.05)

- (3) SF check
 - 1) Connect a wow meter (low-pass 200Hz, UNWTD RMS) to the capstan FG terminal on the SRVO board.
 - 2) Set the PCM-3324 in REC PLAY mode ($f_s = 44.1\text{kHz}$).
 - 3) Fine-adjust the off-set adjusting volumes, **RV102** and **RV202** on the DRV-1 board so that the wow component is minimized.
 - 4) Fine-adjust the $\phi 1$, $\phi 2$ gain balance by using the **RV104** on the DRV-1 board so that the wow component is minimized.
 - 5) Repeat in the sequence of (3) to (4).
 - 6) Fine-adjust using the SF adjusting VR on the SRVO board so that the wow component is minimized.
 - 7) Check the TH and SF.

Also, check the following:

(For TH, setting value: within $200 \pm 20\text{gr}$)
(For SF/TH, within 0.65 ± 0.1)

- 8) When the SF/TH is not 0.65 ± 0.1 .

Note: If no good, either the capstan motor or DRV-1 board will not be well adjusted.

5-2. ADJUSTMENT OF REEL TABLE LEVEL

5-2-1. Adjustment of T-side Reel Table Level

- Loosen two reel table set screws with an L wrench.
- Remove the cover set screw and put an L wrench into the screw hole. Adjust the reel height by turning the adjusting screw with an L wrench.

Clockwise direction → The reel table comes up
Counterclockwise → The reel table goes down direction

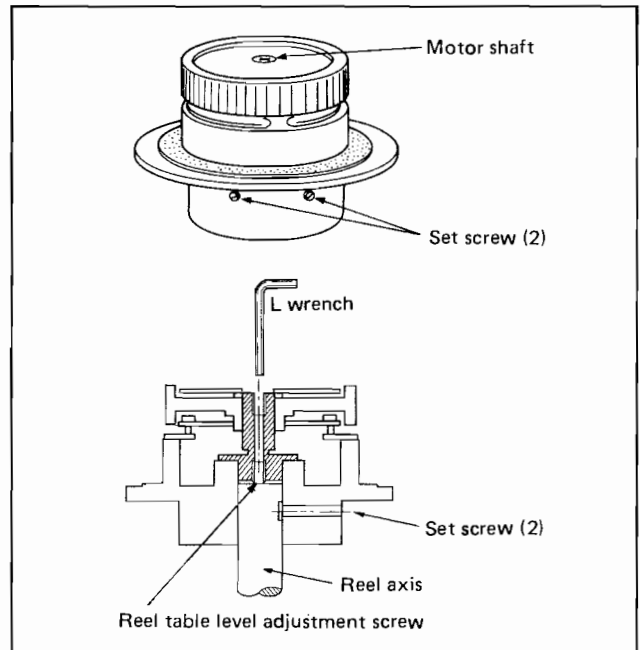


Fig. 5-5.

Adjust the dimension "A" from the installation surface of reel motor to the upper surface of reel table shown in Fig. 5-6 to 46.35 mm.

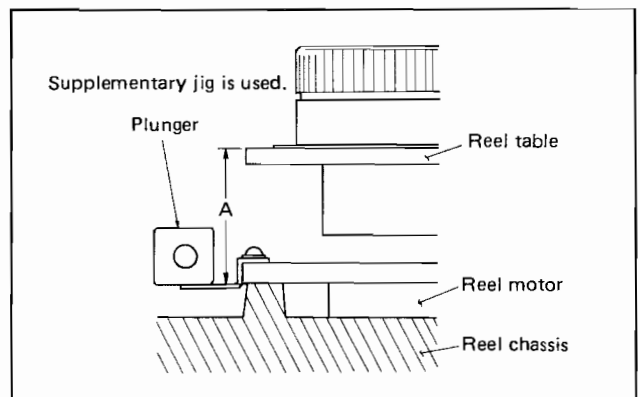


Fig. 5-6.

- Set screws, after adjustment.

5-2-2. Adjustment of S-side Reel Table Level

- Same as the T-side.

5-2-3. Brake Torque Adjustment

- Adjust the dimension "A" and adjust the take-up reel brake as shown below. (Torque Measurement)
- Place a torque adjusting jig onto the reel table and pull the other end of the tension gauge.
- Take-up reel side: Adjust the dimension "A" and brake spring position so that the tension gauge reading is 300 to 400g (35gr) when the reel table is slowly rotated.
- Supply reel side: The tension gauge reading should exceed 50g in the same way as that on the take-up reel side.
- When the torque at the supply side is more than 50g, select "a" to put the compressed spring.
- When the torque at the take-up side is less than 300g, select "c" to put the compressed spring.
- If the above adjustment is not enough, adjust the dimension "A" by moving the stopper plate.
 less than 300g: make dimension "A" large
 more than 400g: make dimension "A" small
 (Preset: A = 1 ~ 1.5 mm)

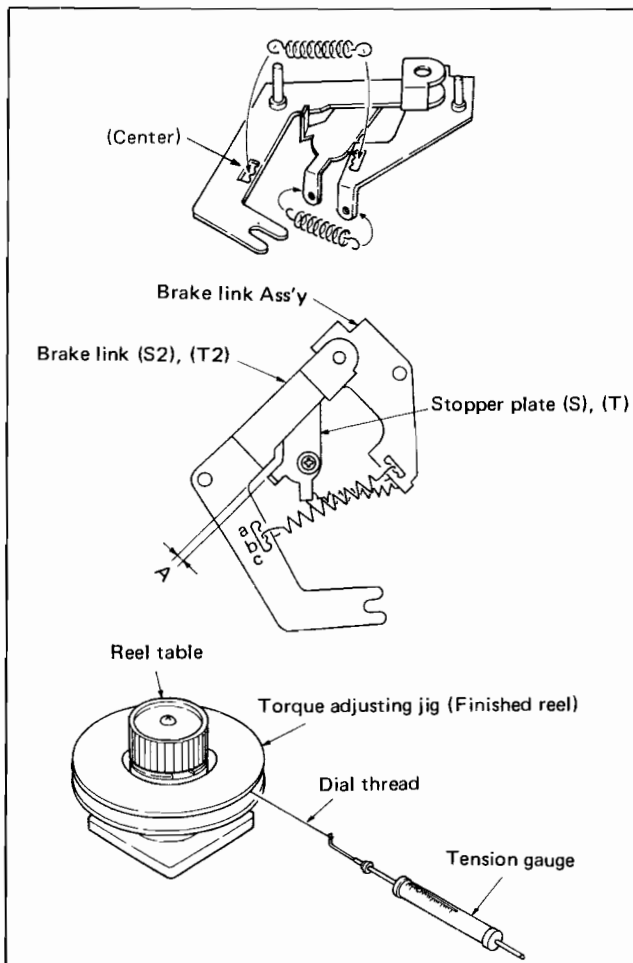


Fig. 5-7.

5-3. ADJUSTMENT OF TAPE SHIFTER AND SHIFT ROLLER POSITIONS

5-3-1. Adjustment of the 1st Retracting Position of Shift Roller

- Supply 4V to the plunger (small), and fix the plunger (small) by using the two set screws at a position where the dimension "A" (in Fig. 5-8) is 79 mm.

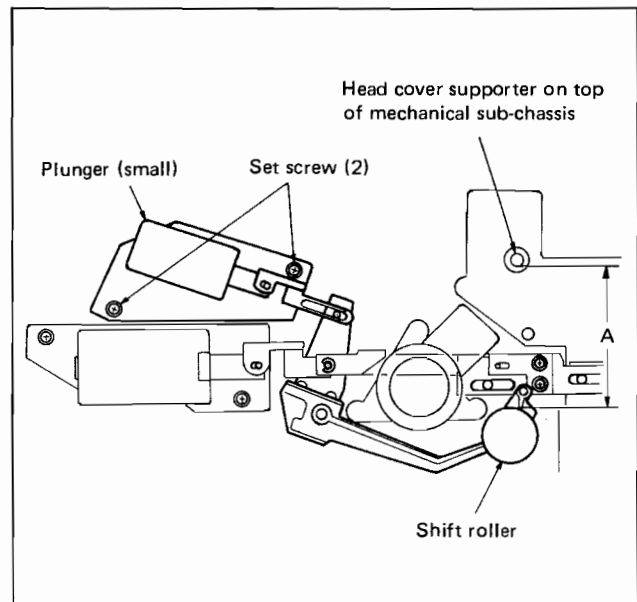


Fig. 5-8.

5-3-2. Adjustment of the 2nd Retracting Position of Shift Roller

- Supply 4V to a plunger (large) and fix the plunger (large) by using the two set screws so that there is a clearance of 0.1 to 0.5mm between the pins indicated by the arrow (in Fig. 5-9).

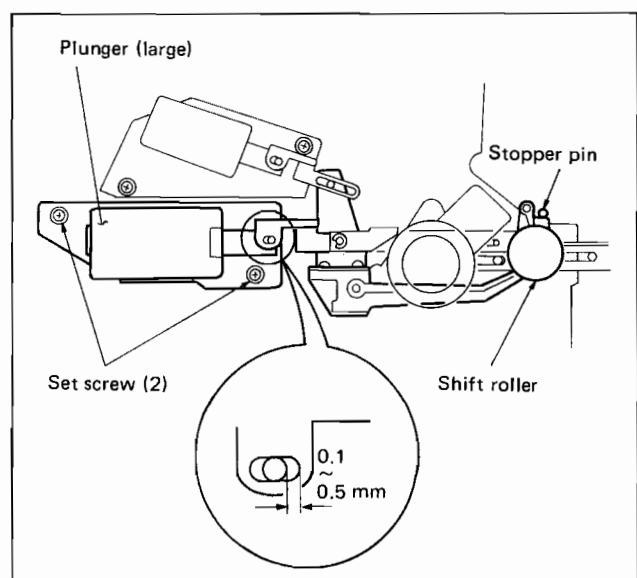


Fig. 5-9.

5-3-3. Adjustment of Shift Roller Brake Damper

Temporary:

- By withdrawing the plunger (large) by hand, adjust the damper (right) so that the time required for the shift roller to return from the FWD position to the MECH STOP position is 0.4 seconds. (Fig. 5-9)
- Adjust the damper (left) so that the time required for the shift roller to return from the E STOP position to the FWD position is 0.4 seconds when 4V is supplied to the plunger (large).

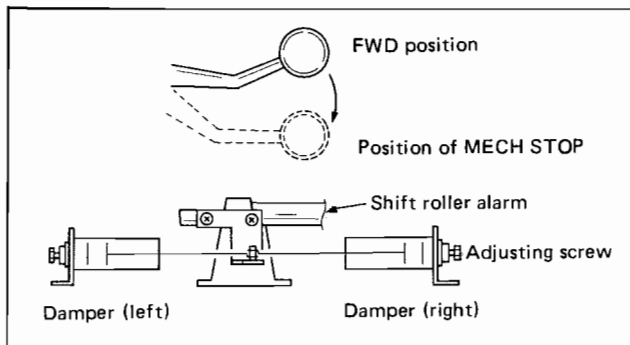


Fig. 5-10.

5-3-4. Adjustment of Tape Shifter Position

- Set the reel, stretch the tape tight, and press the tension disarm switch.
Visually, adjust the position of the shifter and fix by using the two set screws so that the dimension "A" (in Fig. 5-11-1) is 0.5 mm at a position of the tape shifter.
- Adjust the position by using the two set screws on the shifter link (S) so that the tape is placed on top of the head (during tape loading in the STOP mode). (Refer to Fig. A in Fig. 5-11-1.)
- When the tape is loaded and tension arm is turned off, the tape shifter should appear from under the head cover by 0.5 mm. (Refer to Fig. 5-11-2.)

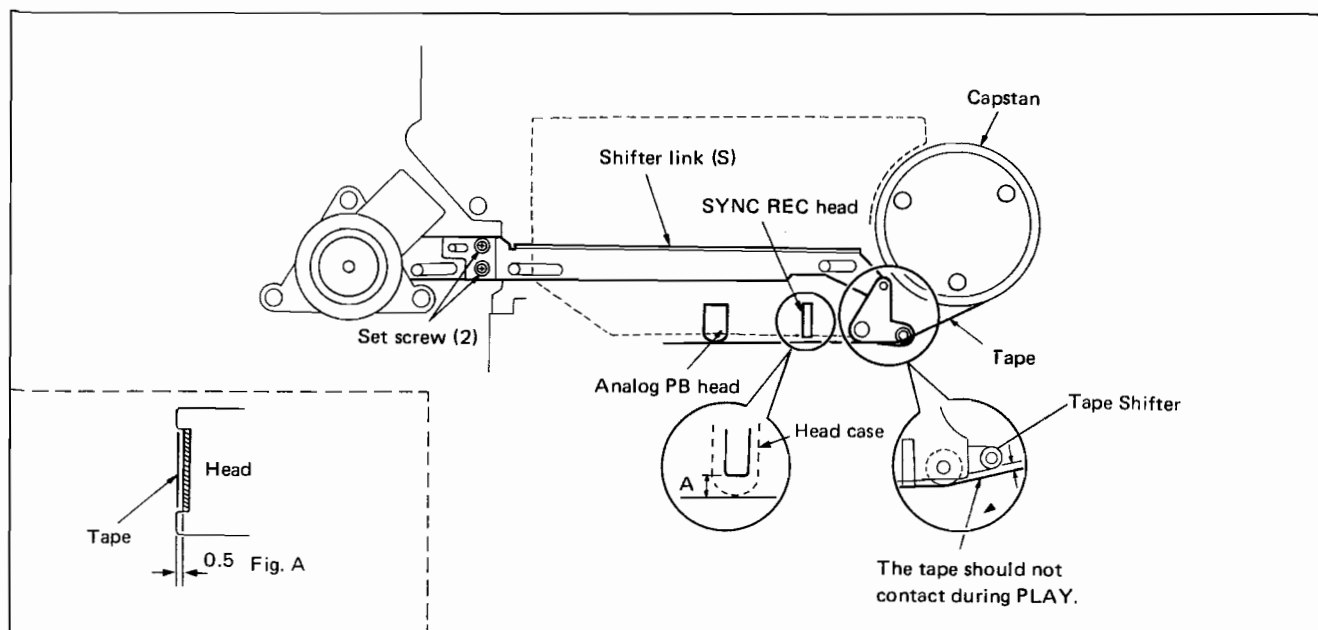


Fig. 5-11-1.

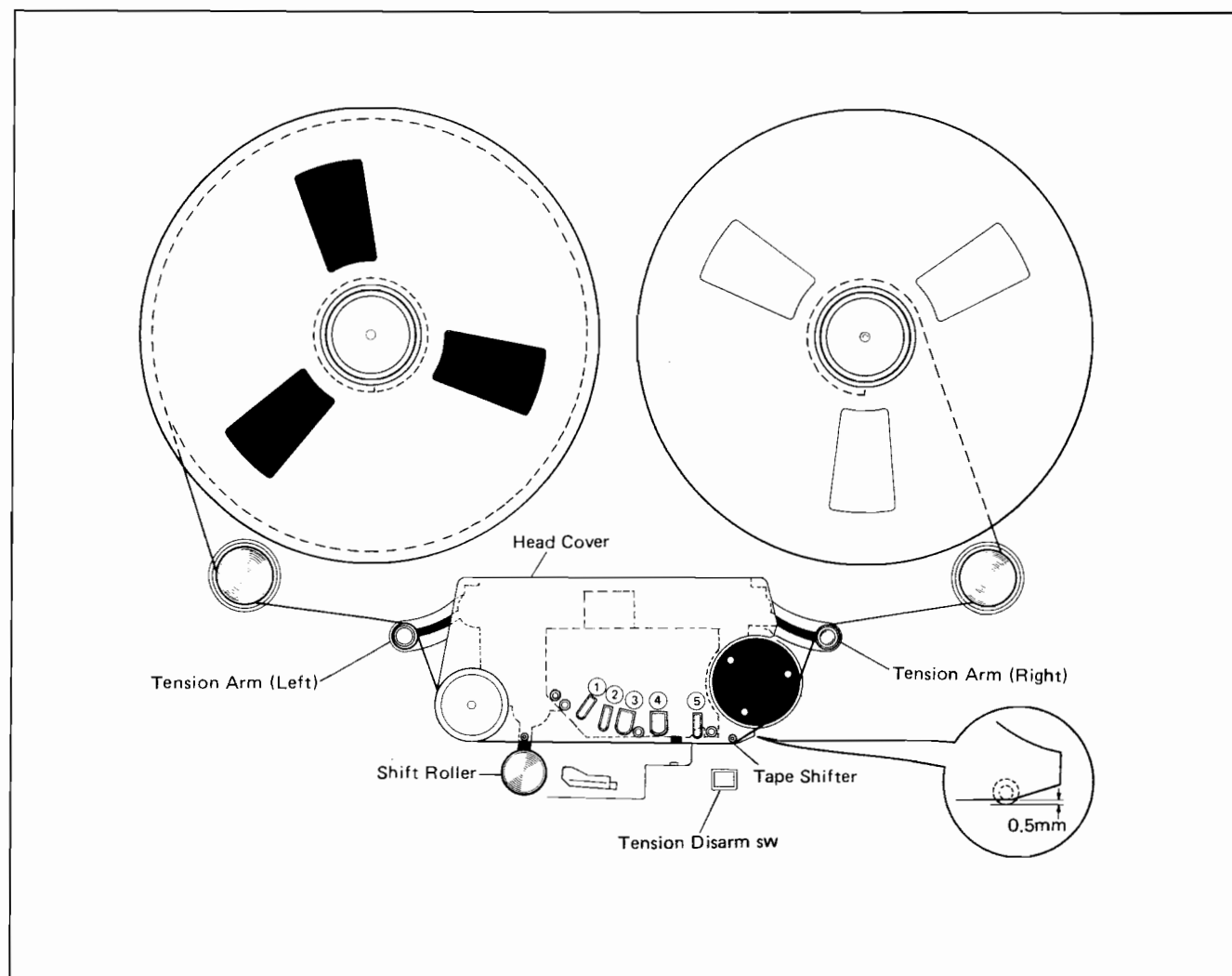


Fig. 5-11-2.

5.4. ADJUSTMENT OF SHUT-OFF POSITION

5-4-1. Adjustment of Photo Interrupter Position

Mount the rear panel of the PH-I cover case tightly onto the edge of the PH-I supporting plate as indicated by the arrow (in Fig. 5-12).

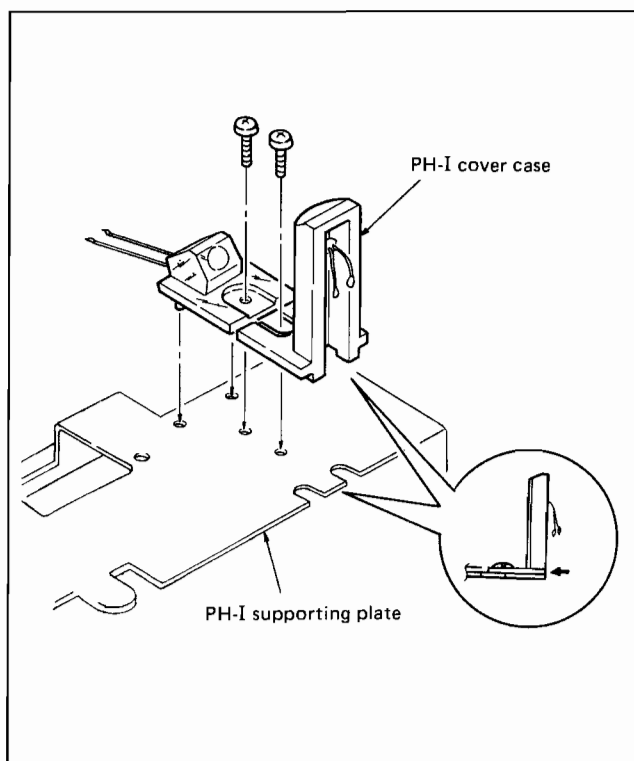


Fig. 5-12.

5.5. ADJUSTMENT OF HEAD FRONT SHIELD POSITION

5-5-1. Head Front Shield Position

- During PLAY, the shield plate should fully contact the shield case. Also, adjust the head shield position by using the adjusting screw so that the clearance A (in Fig. 5-13) is 1 mm or less.

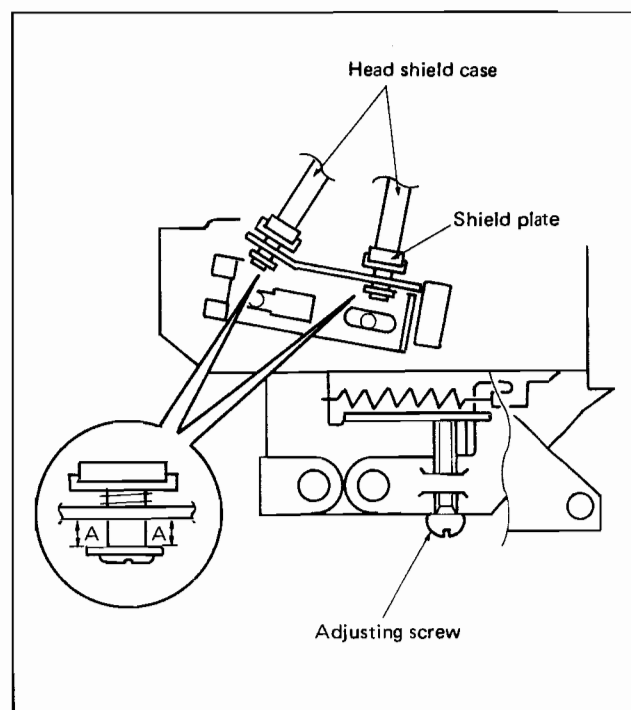


Fig. 5-13.

- When using an adjusted H.B.U, adjust so that the Head shield case touches the shield block.

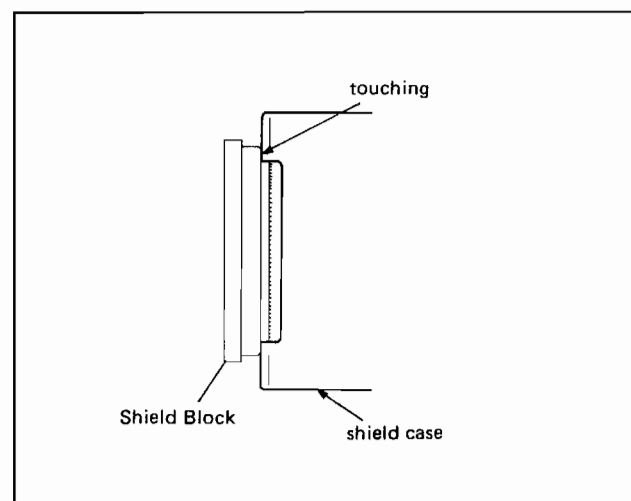
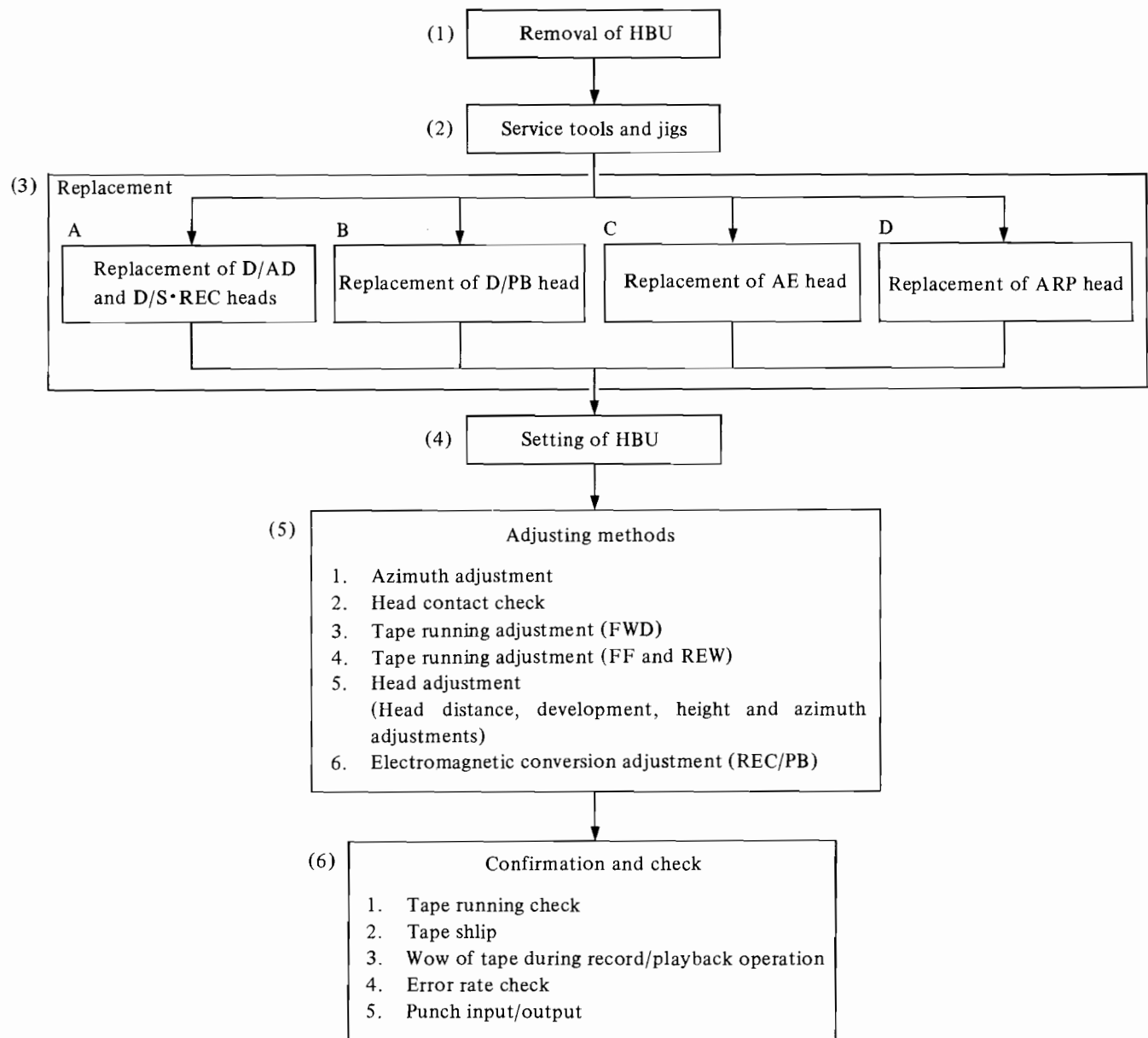


Fig. 5-14.

5-6. REPLACEMENT OF HBU

5-6-1. Replacement of heads

- Configuration



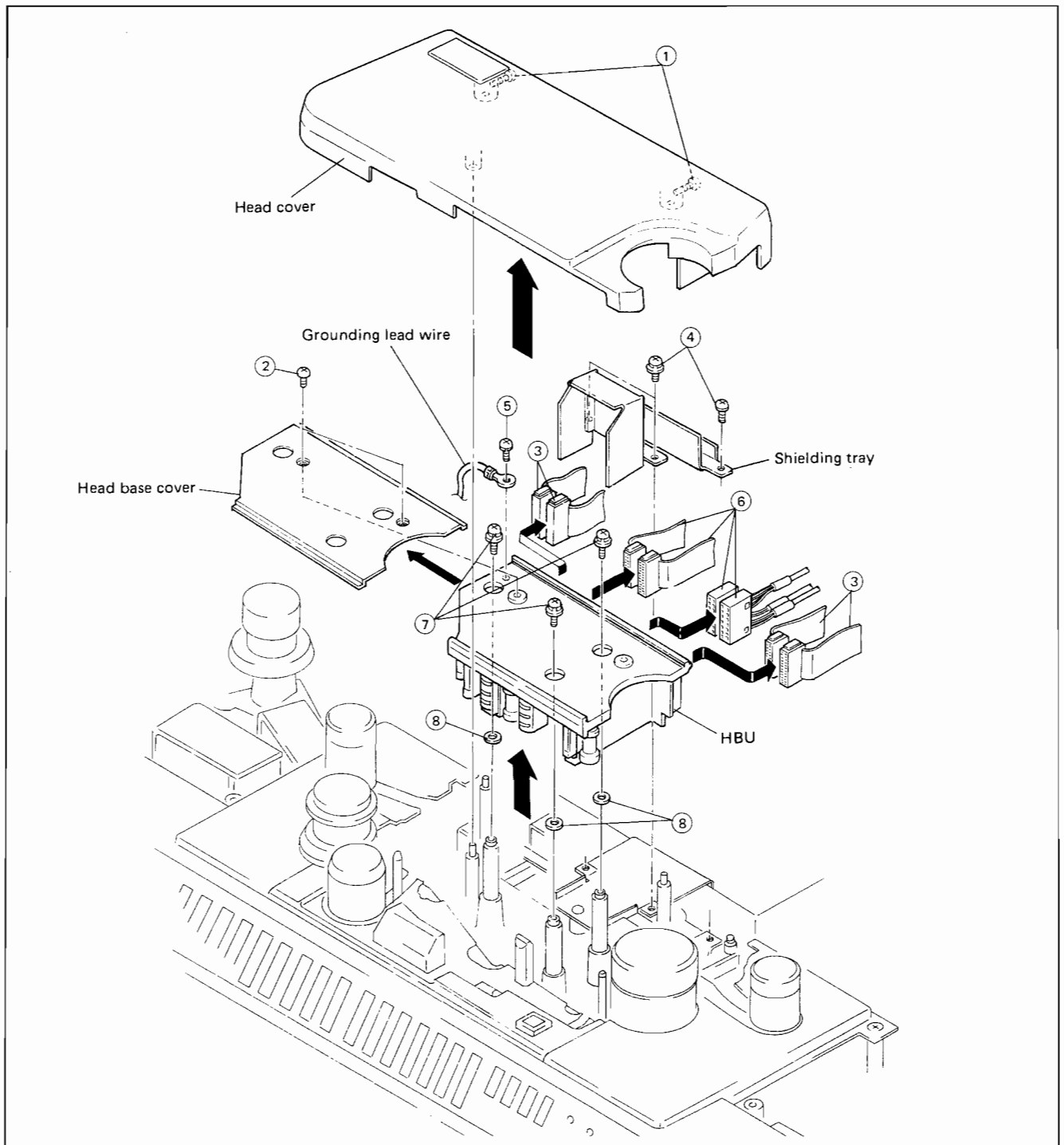
(1) Removal of HBU

- ① Loosen the two screws (P4×8) and remove the head cover.
- ② Remove the two screws (B3×6) and remove the head base cover.
- ③ Pull out the connectors CN1, 2, 7 and 8.
- ④ Remove the three screws (PS3×6) and remove the shielding tray.
- ⑤ Remove the screw (PS3×6) and remove the grounding lead wire.

- ⑥ Pull out the connectors CN3, 4, 5 and 6.

- ⑦ Remove the three screws (PSW4×8) and remove the HBU.

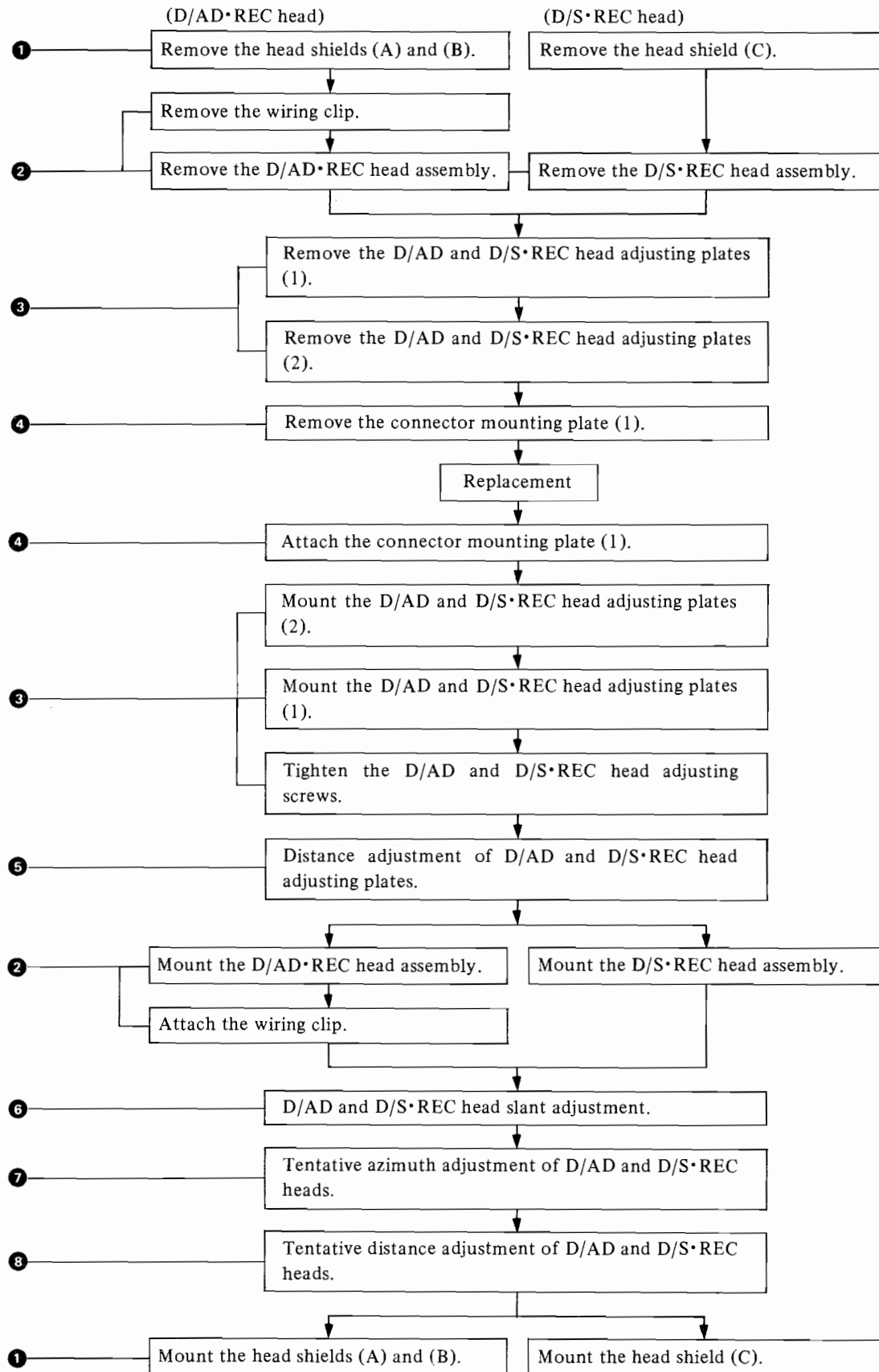
Note: The spacers ⑧ may be inserted into the HBU mounting strut. When replacing the HBU, mount it with the spacers inserted.



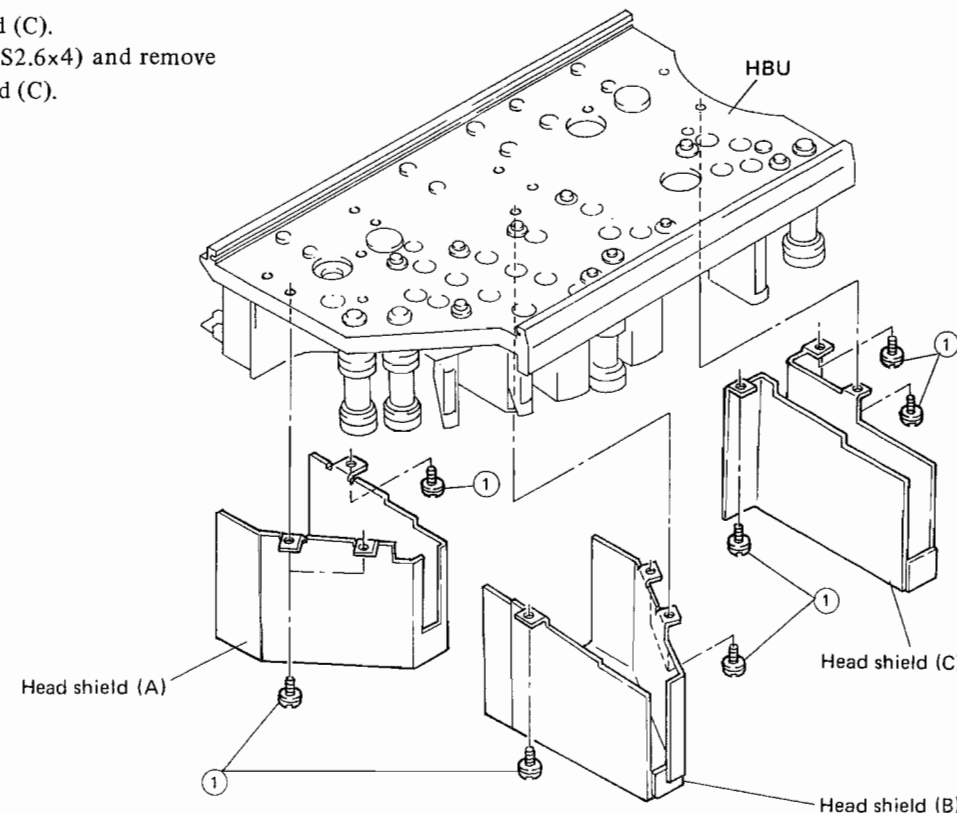
(3) Replacement

A. Replacement of D/AD and D/S•REC heads

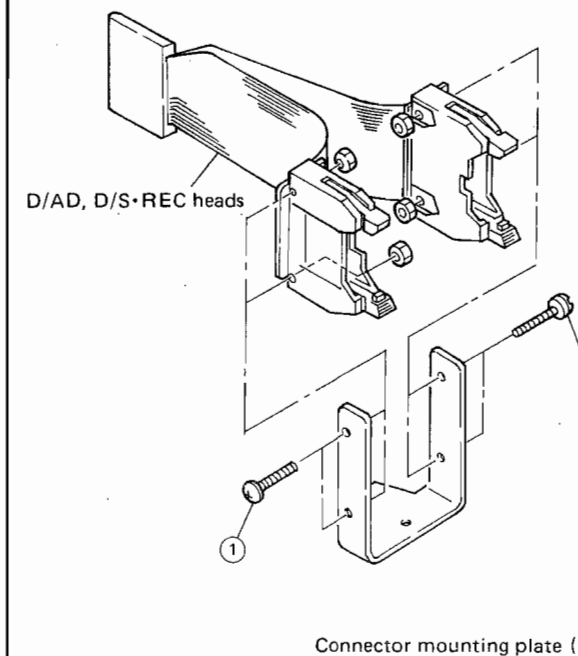
- Configuration



- ④ Head shields (A), (B) and (C).
① Remove the nine screws (PS2.6×4) and remove the head shields (A), (B) and (C).



- ④ Connector mounting plate (1)
① Remove the four screws (PS2×12) and remove the connector mounting plate (1).

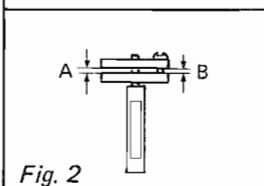
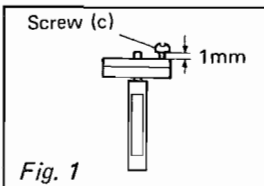
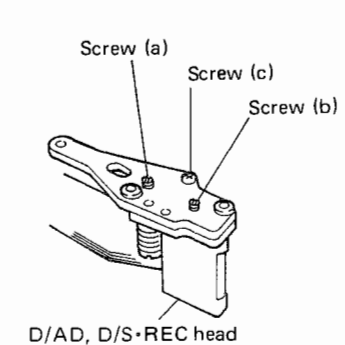


- ⑤ Distance adjustment of D/AD and D/S-REC head adjusting plates
Tools and jigs: $\phi 2.6\text{mm}$ screwdriver
 $\phi 2.9\text{mm}$ flat-bladed clock screwdriver

Spec.: Visual check

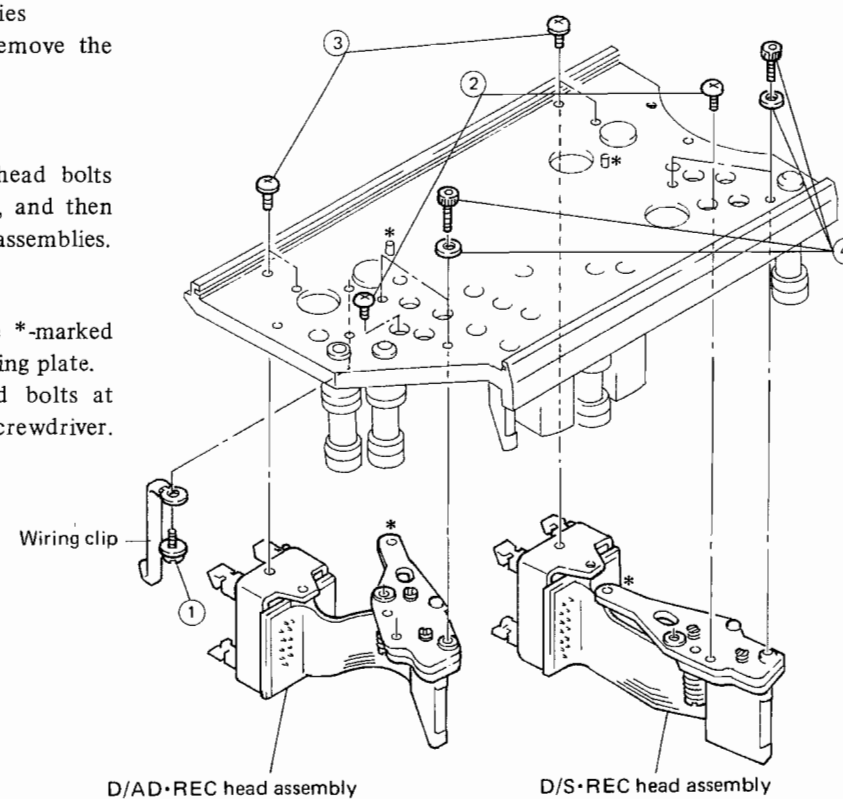
Adjustments:

- ① Loosen the screw (c). (Fig. 1)
② Tighten the screws (a) and (b) by a rotation.
③ Tighten the screw (c) so that the gap A of the adjusting plate is equal to the gap B. (Fig. 2)

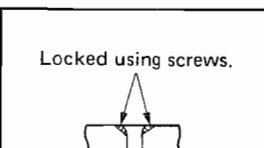
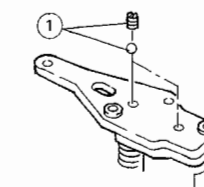
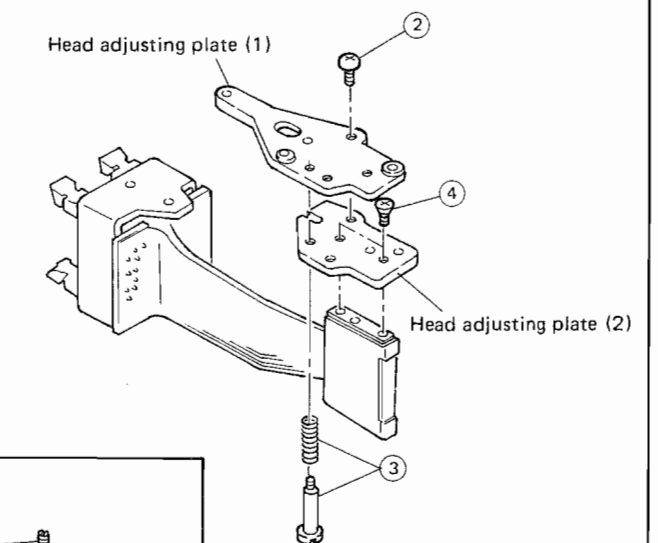


- ② D/AD and D/S-REC head assemblies
① Remove the screw (PS3×5) and remove the wiring clip.
② Remove the two screws (P2.6×5).
③ Remove the two screws (PS2.6×10).
④ Remove the four hexagon socket head bolts (2.6×10) and four washers (W $\phi 2.6$), and then remove the D/AD and D/S-REC head assemblies.

Notes: 1) When assembling, align the *-marked pin with the hole of an adjusting plate.
2) Tighten the hexagonal head bolts at 10kg-cm by using a torque screwdriver.



- ③ D/AD and D/S-REC head adjusting plates (1) and (1), and adjusting screws.
① Remove the two adjusting screws (3×4) and two steel balls ($\phi 2\text{mm}$).
② Remove the screw (P2.6×5).
③ Remove the counter spring axis (2) and the compressed coil spring, and then remove the head adjusting plate (1).
④ Remove the two screws (K2×4) and remove the head adjusting plate (2). (When mounting, tighten by locking the head adjusting plate with screws.)



⑥ D/AD and D/S•REC head slant adjustments

Tools and jigs: Parallel plate

φ2.9mm flat-bladed clock

screwdriver

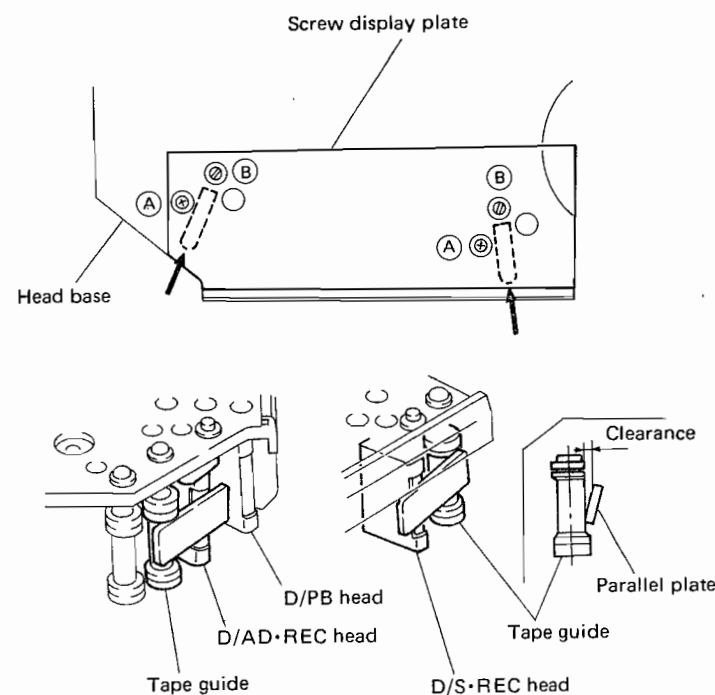
φ2.6mm screwdriver

Screw display plate

Spec.: Visual check (Check that there is no clearance.)

Adjustments:

- ① Align the screw display plate with the screws on HBU to mount it.
- ② Press the parallel plate in the direction indicated by the arrow without damaging the head.
- ③ Check loosening of the screw ① in the screw display plate.
- ④ Turn the screw ② in the screw display plate to adjust it.



⑦ Tentative azimuth adjustment of D/AD and D/S•REC heads

Tools and jigs: Transparent tape for tentative azimuth adjustment

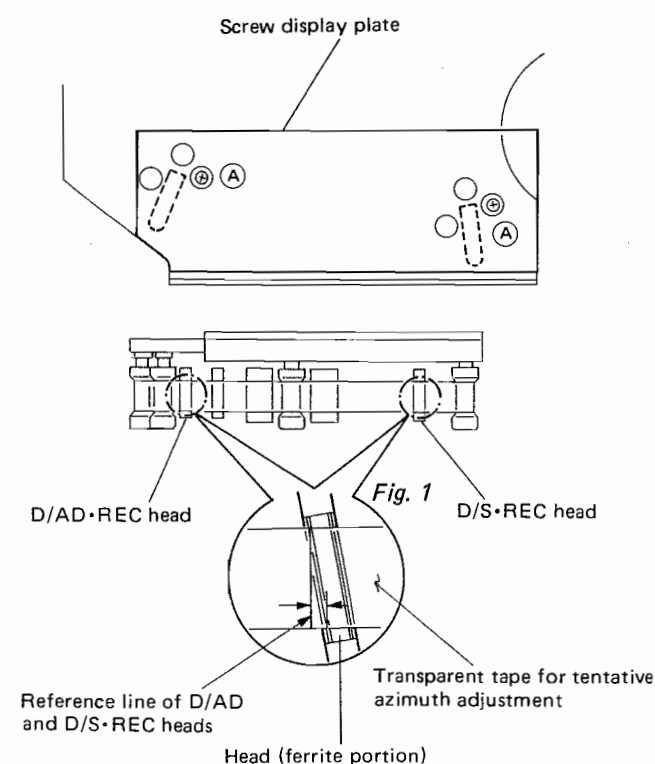
φ2.6mm screwdriver

Screw display plate

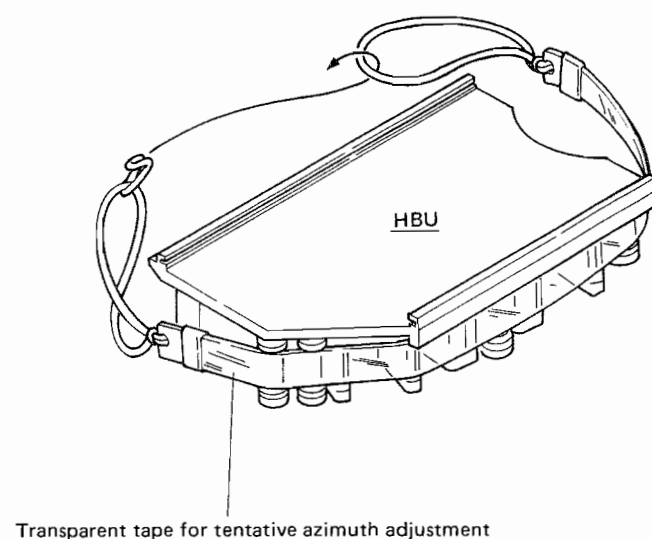
Spec.: Visual check

Adjustments:

- ① Align the screw display plate with the screws on HBU to mount it.
- ② When the upper edge of the reference line of D/AD and D/S•REC heads on the transparent tape for tentative azimuth adjustment is aligned with the edge of the head (ferrite portion), adjust the screw ① so that the lower edge of the reference line coincides with the edge of the head (ferrite portion). (Fig. 1)



- Place the transparent tape for tentative azimuth adjustment along the tape guide of HBU.



⑧ Tentative distance adjustment of D/AD and D/S•REC heads

Tools and jigs: Transparent tape for tentative azimuth adjustment

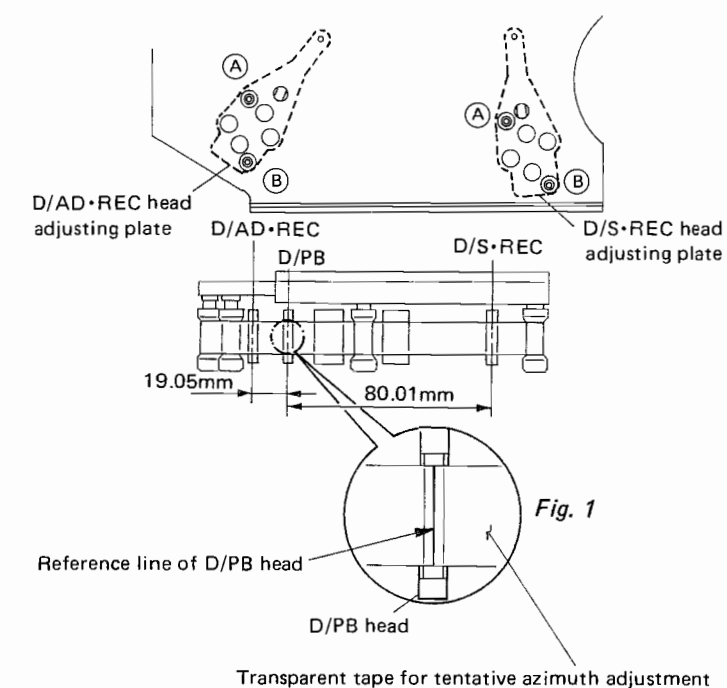
φ6mm hexagonal head screwdriver

Screw display plate

Spec.: Visual check

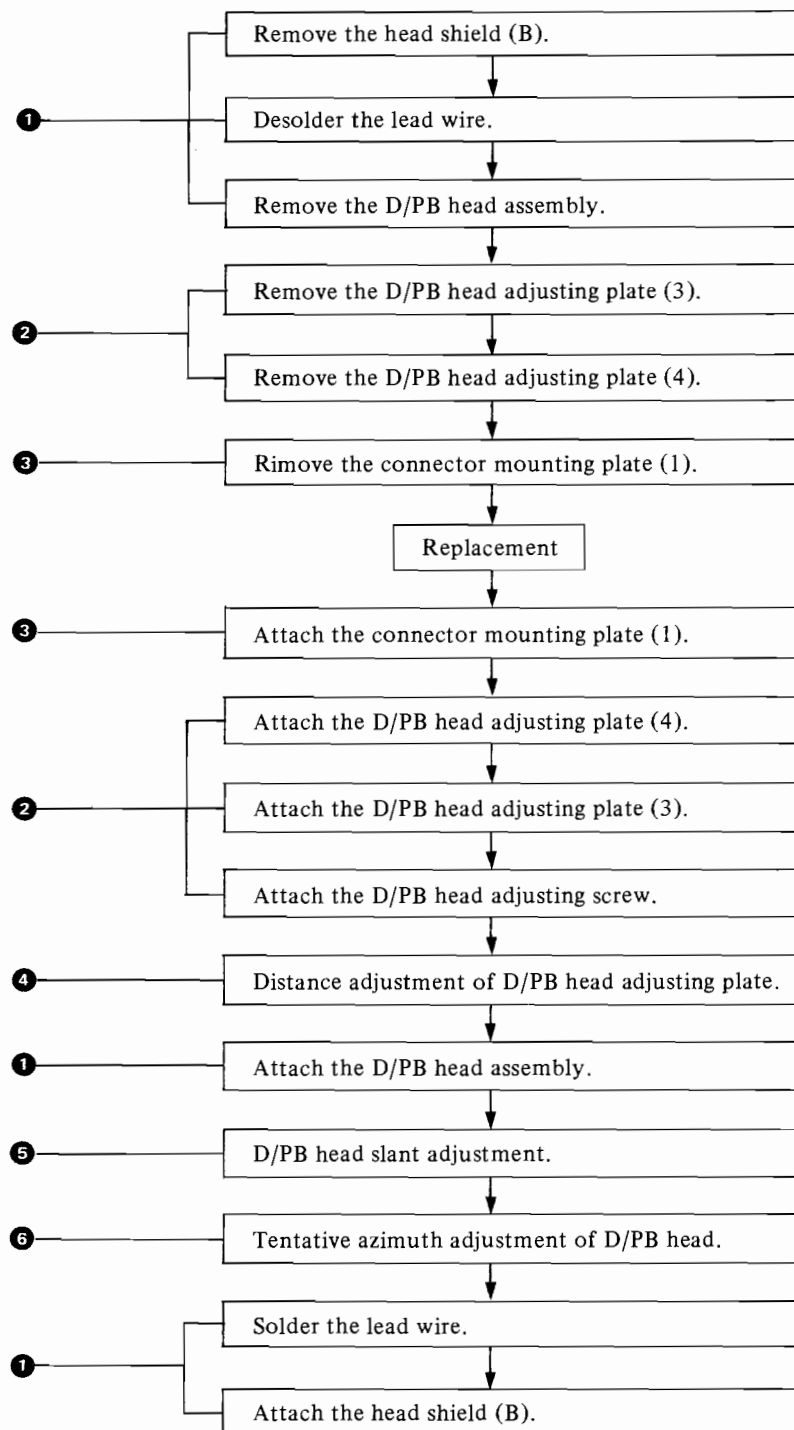
Adjustments:

- ① Align the reference line of D/PB head on the transparent tape for tentative azimuth adjustment with the center of the D/PB head. (Fig. 1)
- ② Loosen the two mounting screws ① and ② of D/AD and D/P•REC head adjusting plates.
- ③ Move the D/AD and D/S•REC head adjusting plates, align the head center with the reference line of D/AD and D/S•REC heads on the transparent tape for tentative azimuth adjustment, and tighten the two mounting screws ① and ②.



B. Replacement of D/PB head

- Configuration

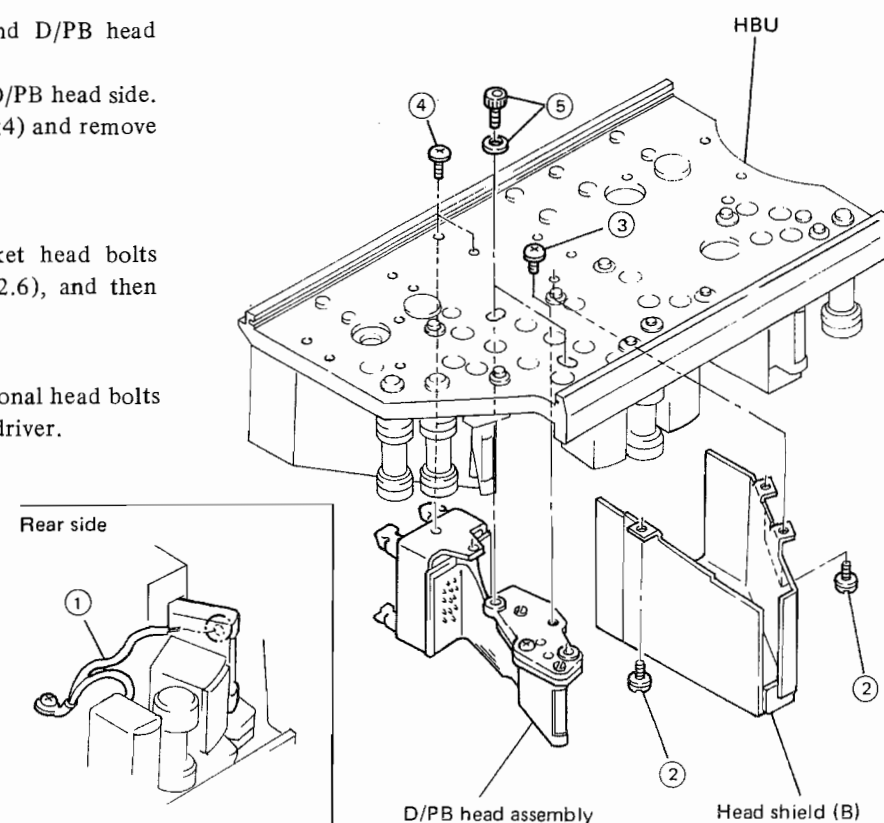


⑫ Head shield (B) soldering and D/PB head assembly

- ① Desolder the lead wire from the D/PB head side.
- ② Remove the three screws (PS2.6x4) and remove the head shield (B).
- ③ Remove the screw (P2.6x5).
- ④ Remove the screw (PS2.6x10).
- ⑤ Remove the two hexagon socket head bolts (2.6x10) and two washers (Wφ2.6), and then remove the D/PB head assembly.

NOTE:

When assembling, tighten the hexagonal head bolts at 10kg-cm by using a torque screwdriver.



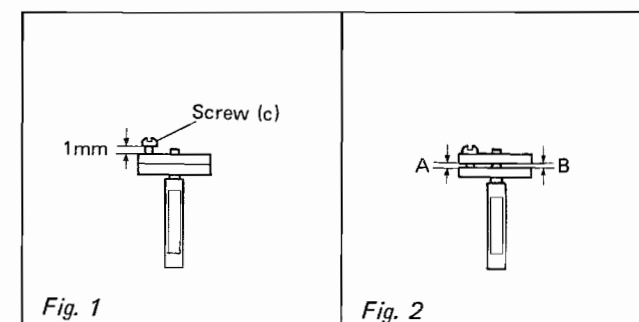
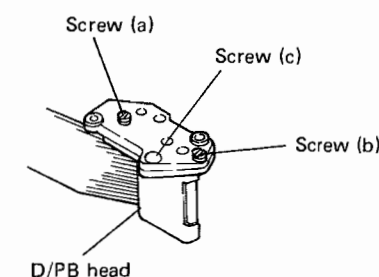
⑬ Distance adjustment of D/PB head adjusting plate

Tools and jigs: φ2.6mm screwdriver
φ2.9mm flat-bladed clock screwdriver

Spec: Visual check

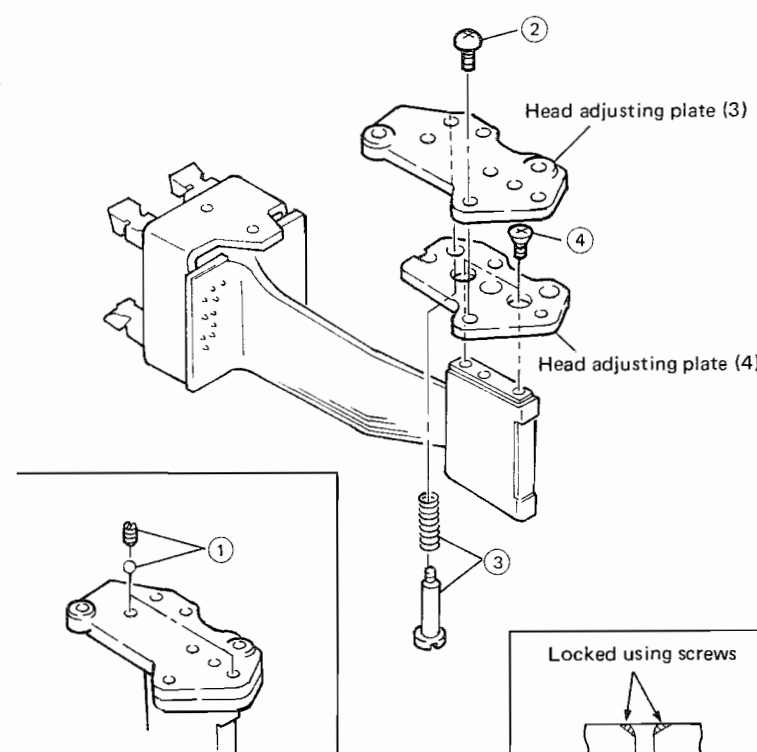
Adjustment:

- ① Loosen the screw (c). (Fig. 1)
- ② Tighten the screws (a) and (b) by a rotation.
- ③ Tighten the screw (c) so that the gap A of the head adjusting plate is equal to the gap B. (Fig. 2)



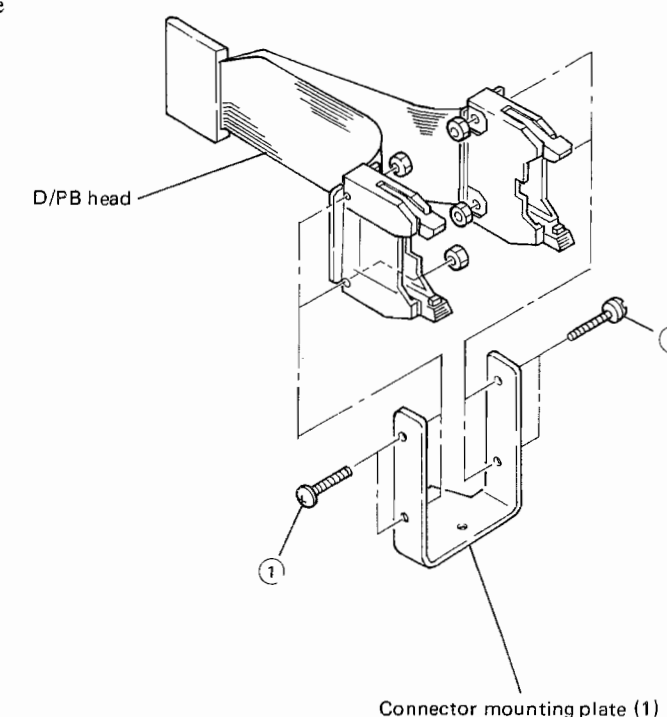
⑭ D/PB head adjusting plates (3) and (4), and adjusting screws

- ① Remove the two adjusting screws (3x4) and two steel balls (φ2mm).
- ② Remove the screw (P2.6x5).
- ③ Remove the counter spring axis (2) and the compressed coil spring, and then remove the head adjusting plate (3).
- ④ Remove the two screws (K2x4) and remove the head adjusting plate (4). (When mounting, tighten by locking the head adjusting plate with screws.)



⑮ Connector mounting plate

- ① Remove the four screws (PS2x12) and remove the connector mounting plate (1).



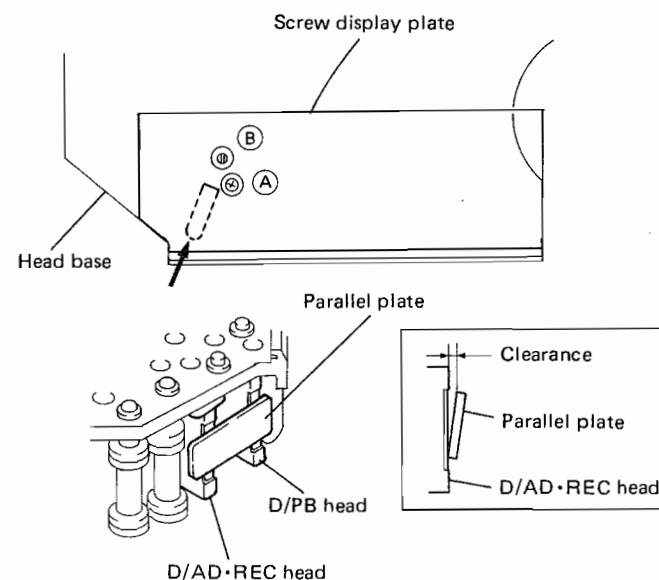
5 D/PB head slant adjustment

Tools and jigs: Parallel plate
 $\phi 2.9\text{mm}$ flat-bladed clock
 screwdriver
 $\phi 2.6\text{mm}$ screwdriver
 Screw display plate

Spec: Visual check (Check that there is no clearance.)

Adjustments:

- ① Align the screw display plate with the screws on HBU to mount it.
- ② Press the parallel plate in the direction indicated by the arrow without damaging the head.
- ③ Check loosening of the screw (A) in the screw display plate.
- ④ Turn the screw (B) in the screw display plate to adjust it.



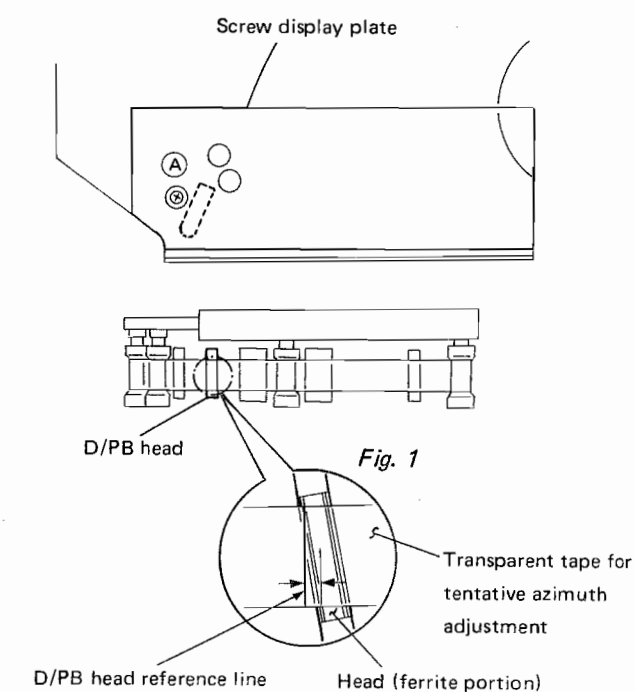
6 Tentative azimuth adjustment of D/PB head

Tools and jigs: Transparent tape for tentative
 azimuth adjustment
 $\phi 2.6\text{mm}$ screwdriver
 Screw display plate

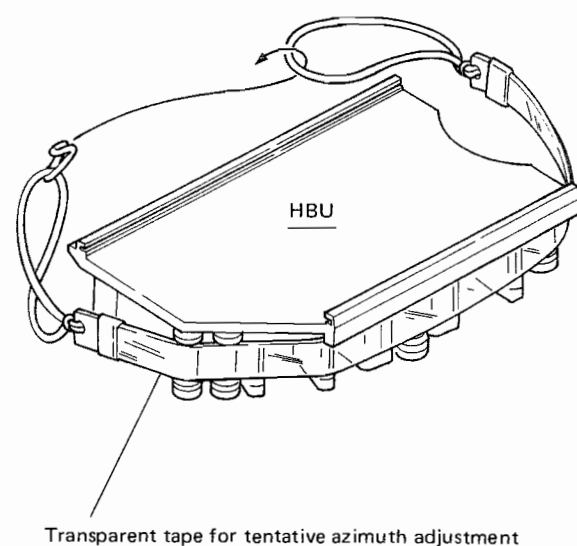
Spec: Visual check

Adjustments:

- ① Align the screw display plate with the screw on HBU to mount it.
- ② When the upper edge of the D/PB head reference line on the transparent tape for tentative azimuth adjustment is aligned with the edge of the head (ferrite portion), adjust the screw (A) so that the lower edge of the reference line coincides with the edge of the head (ferrite portion). (Fig. 1)

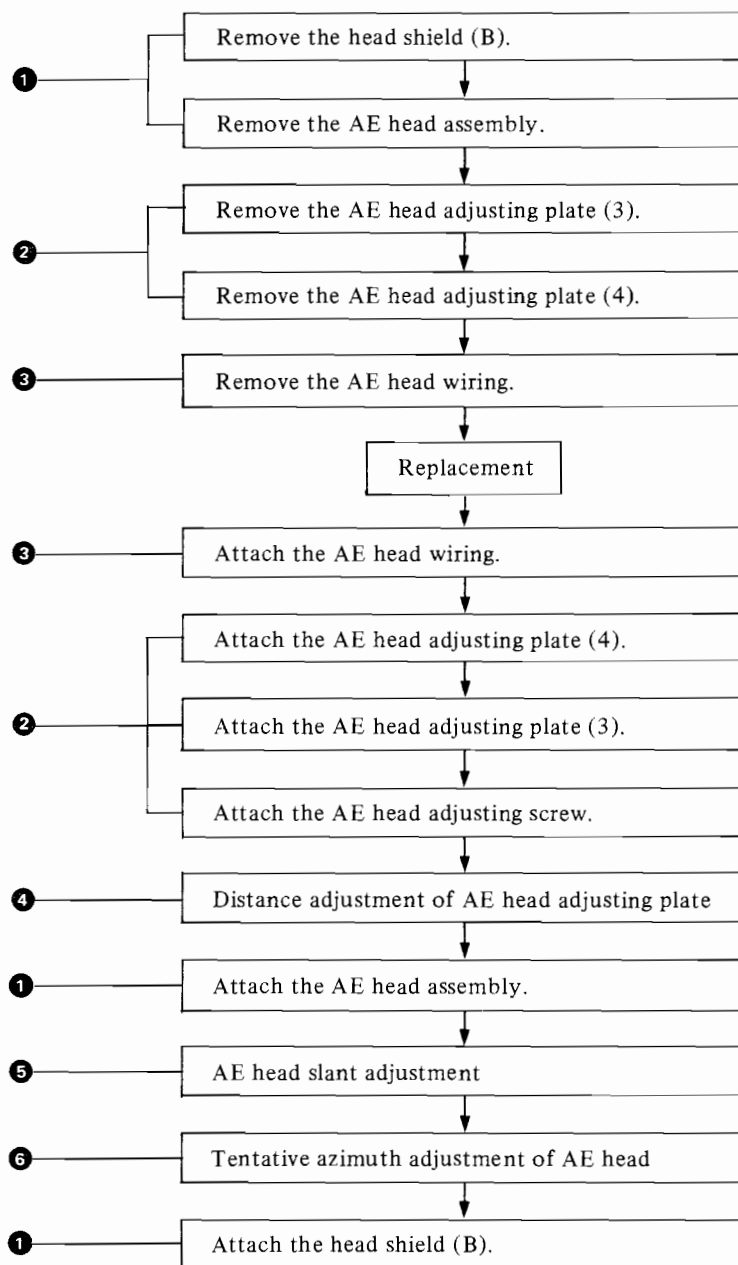


- Place the transparent tape for tentative azimuth adjustment along the tape guide of HBU.



C. Replacement of AE head

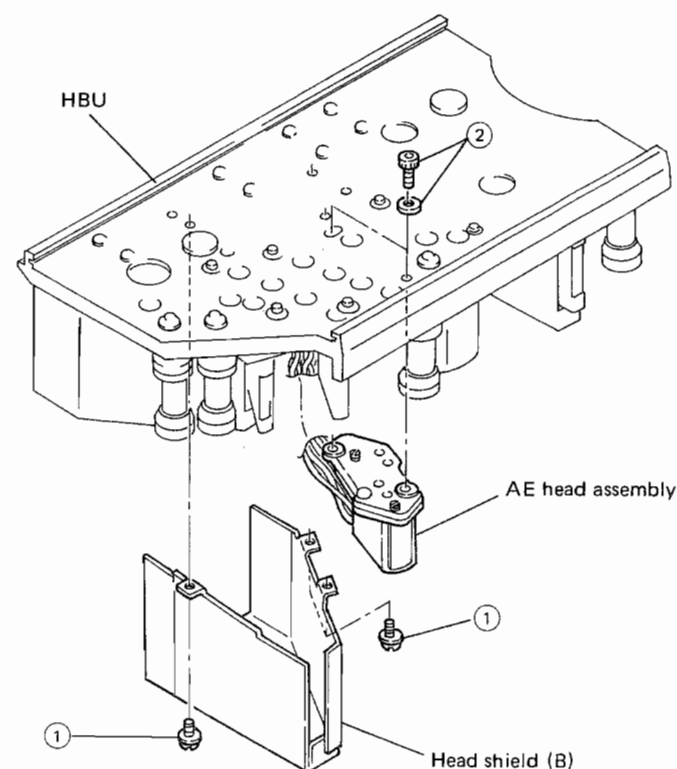
- Configuration



- ⑪ Head shield (B) and AE head assembly
- ① Remove the three screws (PS2.6×4) and remove the head shield (B).
 - ② Remove the two hexagon socket head bolts (2.6×10) and two washers (Wφ2.6), and then remove the AE head assembly.

NOTE:

When assembling, tighten the hexagonal head bolts at 10kg-cm by using a torque screwdriver.



- ⑫ Distance adjustment of AE head adjusting plate

Tools and jigs: φ2.6mm screwdriver
φ2.9mm flat-bladed clock screwdriver

Spec: Visual check

Adjustments:

- ① Loosen the screw (c). (Fig. 1)
- ② Tighten the screws (a) and (b) by a rotation.
- ③ Tighten the screw (c) so that the gap A of the adjusting plate is equal to the gap B. (Fig. 2)

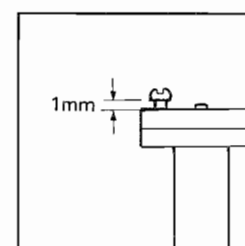
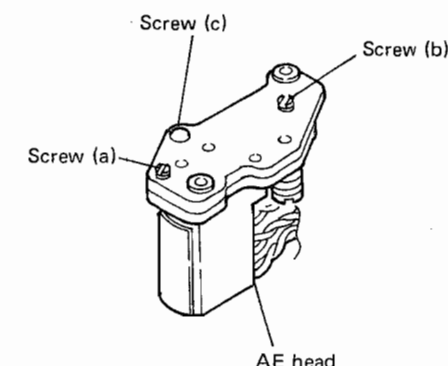


Fig. 1

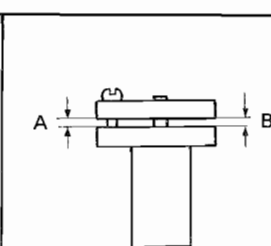
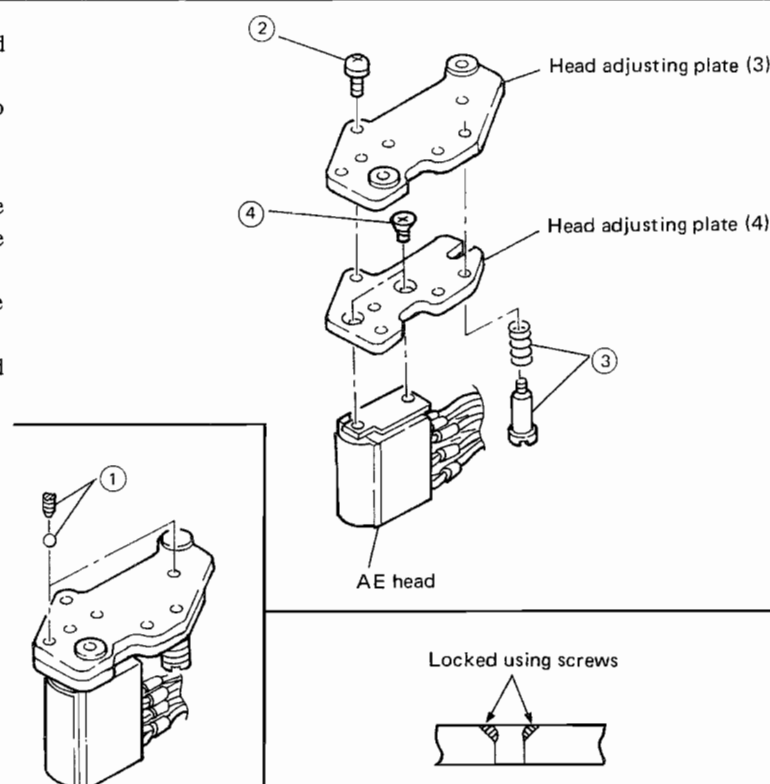


Fig. 2

- ⑬ AE head adjusting plates (3) and (4), and adjusting screws

- ① Remove the two adjusting screws (3×4) and two steel balls (φ2mm).
- ② Remove the screw (P2.6×5).
- ③ Remove the counter spring axis (1) and the compressed coil spring, and then remove the head adjusting plate (3).
- ④ Remove the two screws (K2×4) and remove the head adjusting plate (4).
(When mounting, tighten by locking the head adjusting plate with screws.)



- ⑭ Wiring of AE head

Tools and jigs: Soldering iron (30W)
Tweezers

To remove;

- ① Desolder the lead wires No. 1 through 6 by using a soldering iron.

To attach;

- ① Wind a protective tape on the AE head (EF-240-6803). (Fig. 1)
- ② Wire the lead wires No. 1 through 6 as shown in Fig. 2.



Fig. 1

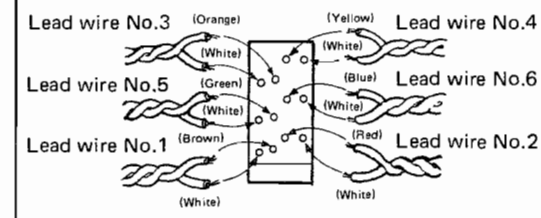
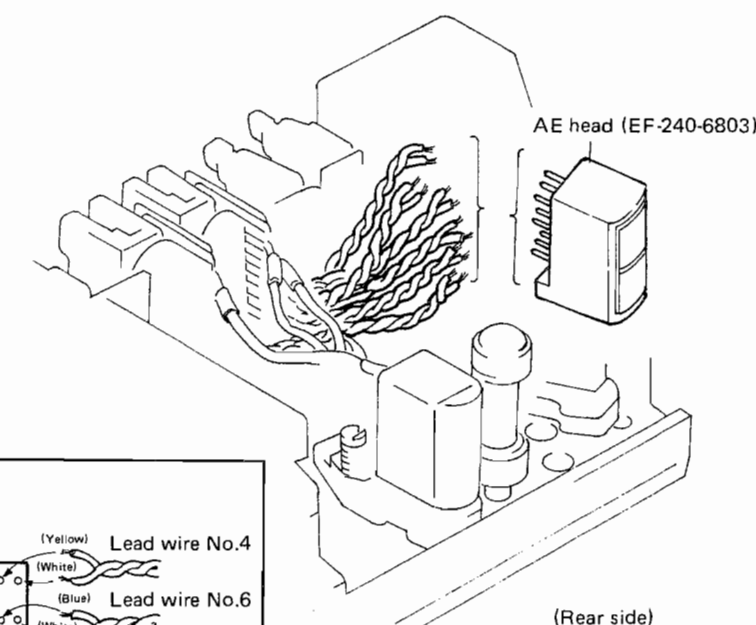


Fig. 2



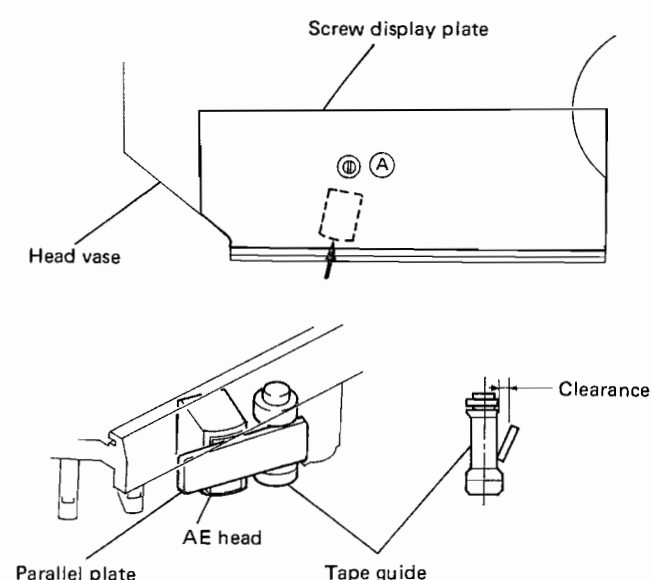
⑤ AE head slant adjustment

Tools and jigs: Parallel plate
 $\phi 2.9\text{mm}$ flat-bladed clock
 screwdriver
 Screw display plate

Spec: Visual check (Check that there is no clearance.)

Adjustments:

- ① Align the screw display plate with the screws on HBU to mount it.
- ② Press the parallel plate in the direction indicated by the arrow without damaging the head.
- ③ Turn the screw (A) in the screw display plate to adjust it.



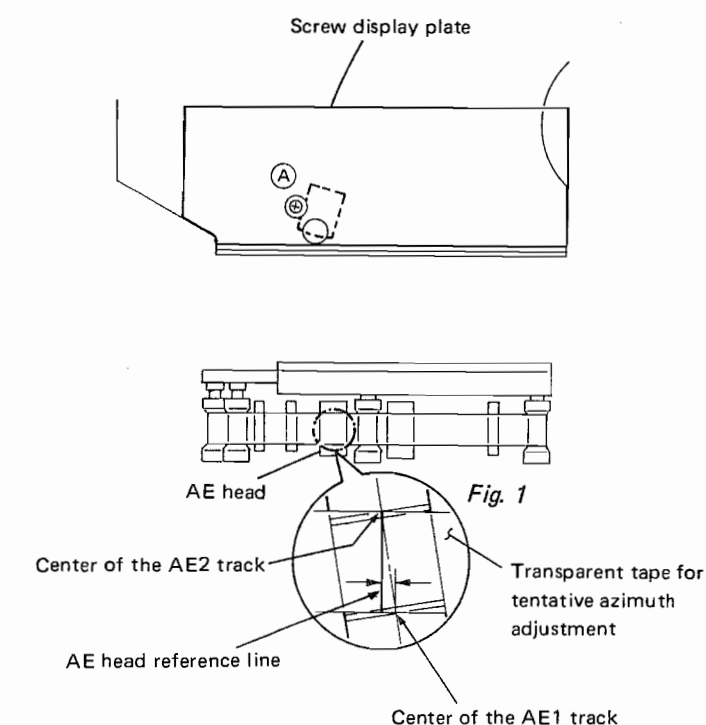
⑥ Tentative azimuth adjustment of AE head

Tools and jigs: Transparent tape for tentative
 azimuth adjustment
 $\phi 2.6\text{mm}$ screwdriver
 Screw display plate

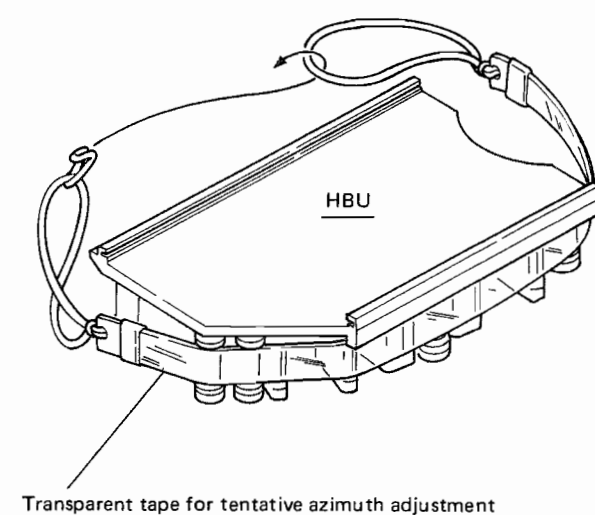
Spec: Visual check

Adjustments:

- ① Align the screw display plate with the screws on HBU to mount it.
- ② When the upper edge of the AE head reference line of the transparent tape for tentative azimuth adjustment is aligned with the center of the AE2 track, adjust the screw (A) so that the lower edge of the reference line coincides with the center of the AE1 track. (Fig.1)



- Place the transparent tape for tentative azimuth adjustment along the tape guide of HBU.



1

2

3

4

5

6

7

8

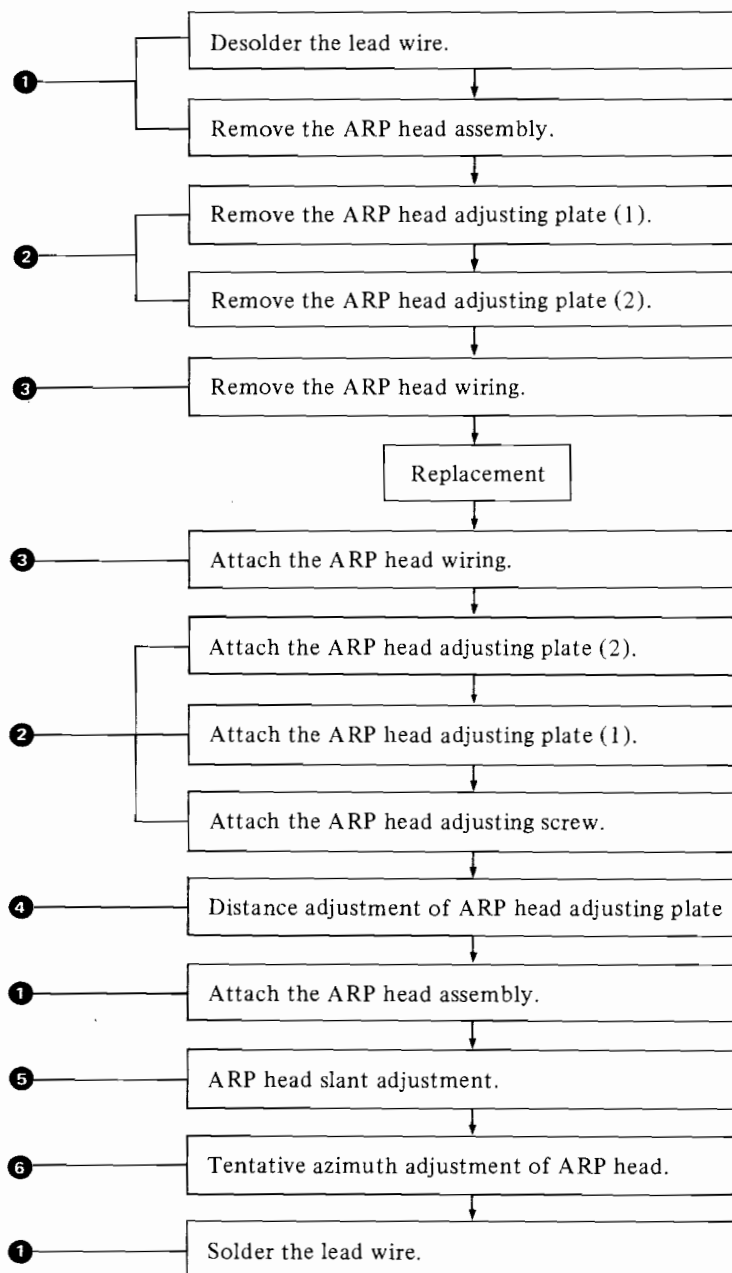
9

10

11

D. Replacement of ARP head

- Configuration

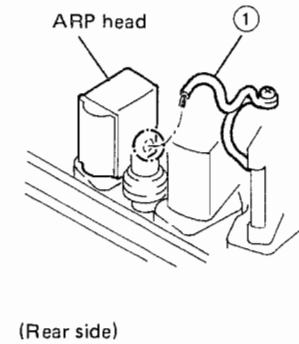
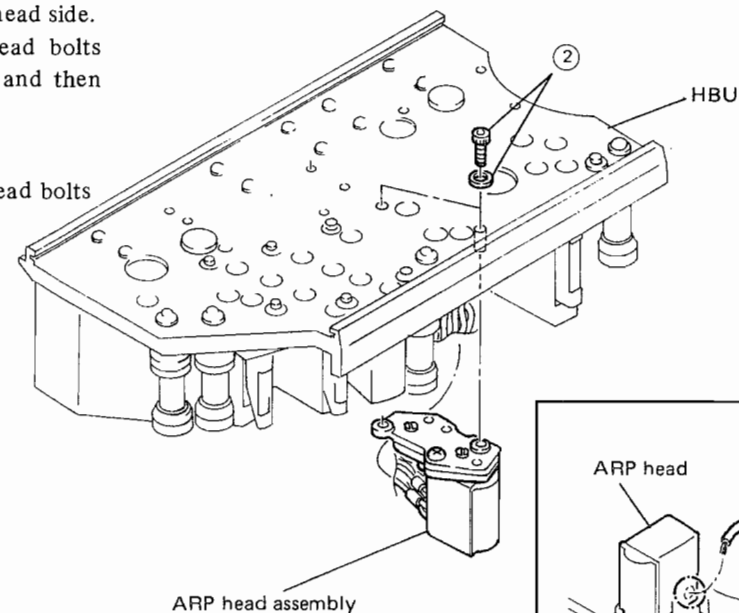


④ ARP head assembly and soldering

- ① Desolder the lead wire from the ARP head side.
- ② Remove the two hexagon socket head bolts (2.6x10) and two washers (Wφ2.6), and then remove the ARP head assembly.

NOTE:

When assembling, tighten the hexagonal head bolts at 10kg-cm by using a torque screwdriver.



④ Distance adjustment of ARP head adjusting plate

Tools and jigs: φ2.6mm screwdriver
φ2.9mm flat-bladed clock screwdriver

Spec: Visual check

Adjustments:

- ① Loosen the screw (c). (Fig. 1)
- ② Tighten the screws (a) and (b) by a rotation.
- ③ Tighten the screw (c) so that the gap A of the adjusting plate is equal to the gap B. (Fig. 2)

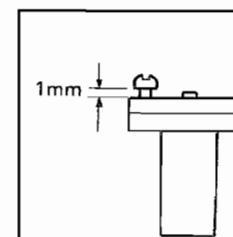
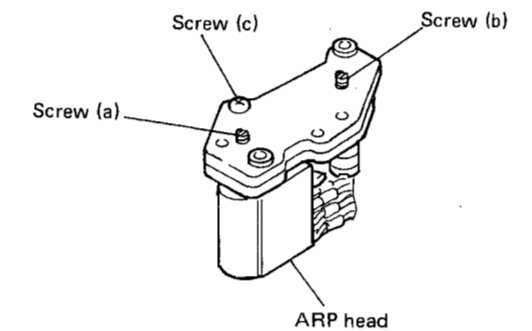


Fig. 1

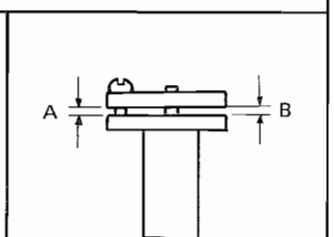
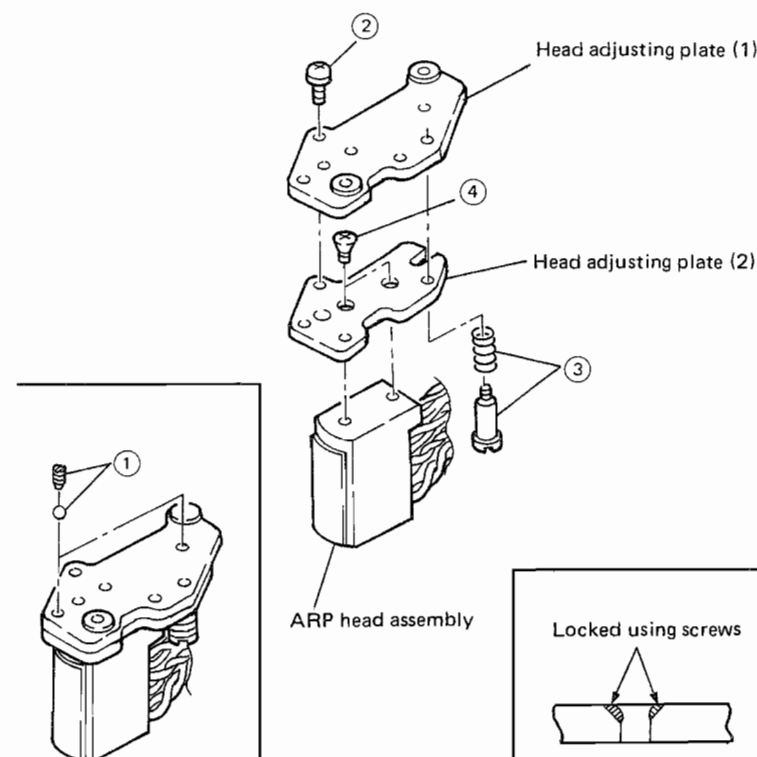


Fig. 2

② ARP head adjusting plates (1) and (2), and adjusting screws

- ① Remove the two adjusting screws (3x4) and two steel balls (φ2mm).
- ② Remove the screw (P2.6x5).
- ③ Remove the counter spring axis (2) and the compressed coil spring, and then remove the head adjusting plate (1).
(When mounting, tighten by locking the adjusting plate with screws.



③ ARP head wiring

Tools and jigs: Soldering iron (30W)
Tweezers

To remove;

- ① Desolder the lead wires No. 7 through 12 by using a soldering iron.

To attach;

- ① Wind a protective tape on the ARP head (PF-241-6803). (Fig. 1).
- ② Wire the lead wires No. 7 through 12 as shown in Fig. 2.



Fig. 1

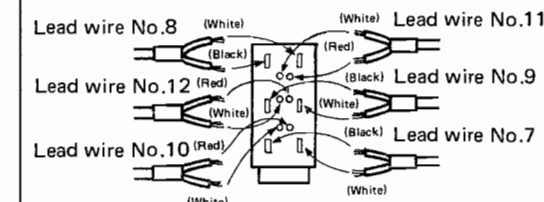
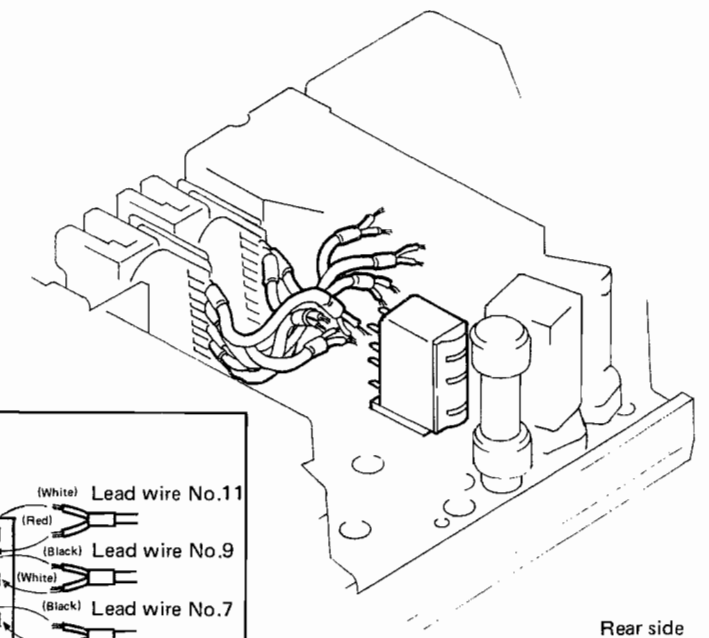


Fig. 2



Rear side

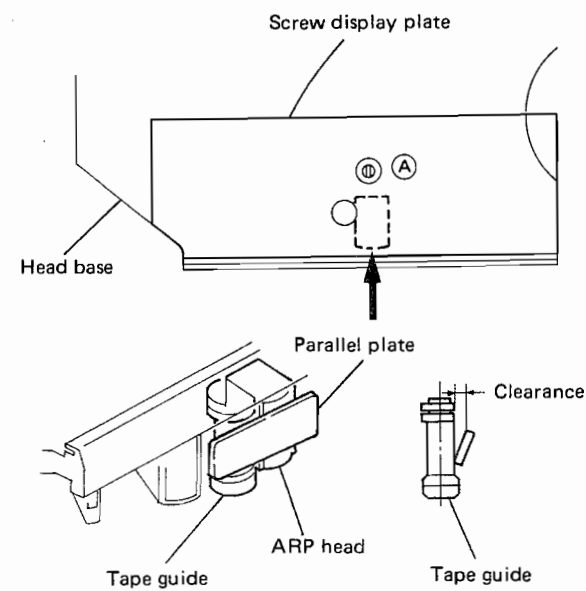
⑤ ARP head slant adjustment

Tools and jigs: Parallel plate
 Screw display plate

Spec: Visual check (Check that there is no clearance.)

Adjustments:

- ① Align the screw display plate with the screw on HBU to mount it.
- ② Press the parallel plate in the direction indicated by the arrow without damaging the head.
- ③ Turn the screw ① in the screw display plate to adjust it.



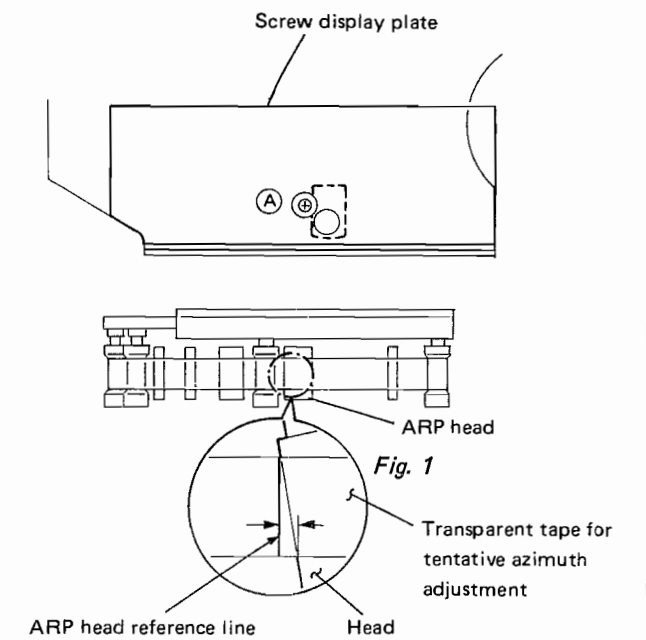
⑥ Tentative azimuth adjustment of ARP head

Tools and jigs: Transparent tape for tentative azimuth adjustment
 Screw display plate
 Screw display plate

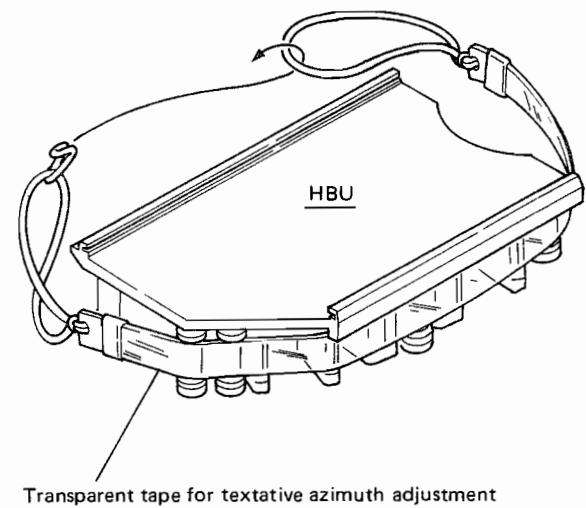
Spec: Visual check

Adjustments:

- ① Align the screw display plate with the screw on HBU to mount it.
- ② When the upper edge of the ARP head reference line on the transparent tape for tentative azimuth adjustment is aligned with the edge of the head, adjust the screw ① so that the lower edge of the reference line coincides with the edge of the head. (Fig. 1)



- Place the transparent tape for tentative azimuth adjustment along the tape guide of HBU.



(4) Setting of HBU

Referring to 5-6-1. (1) "Removal of HBU", set HBU in the reverse manner.

Clamping torque

Tighten at 16kg-cm using a torque screwdriver.

(5) Adjusting Methods

<1> Azimuth adjustment

1) Azimuth adjustment of D/REC head (2)

1. Turn the screw ③ to fine-adjust using the azimuth tape D.
2. Tighten the screw ④. (30μsec)
(Refer to Fig. 5-1.)

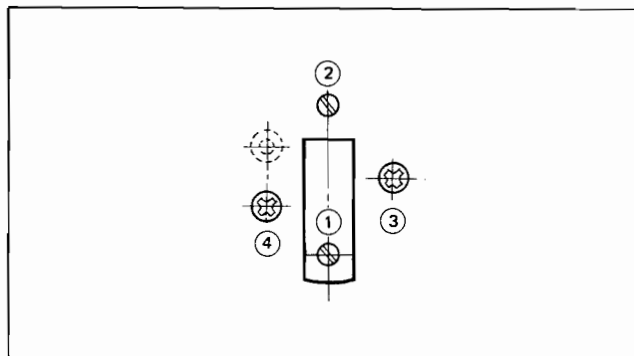


Fig. 5-1. Arrangement of D/REC head adjusting screw

2) Azimuth adjustment of D/PB head

1. Turn the screw ③ to fine-adjust using the azimuth tape D.
2. Tighten the screw ④. (40μsec)
(Refer to Fig. 5-4.)

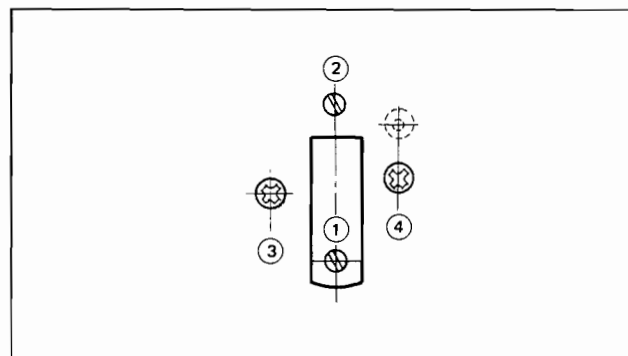


Fig. 5-4. Arrangement of D/PB head adjusting screw

Azimuth tape

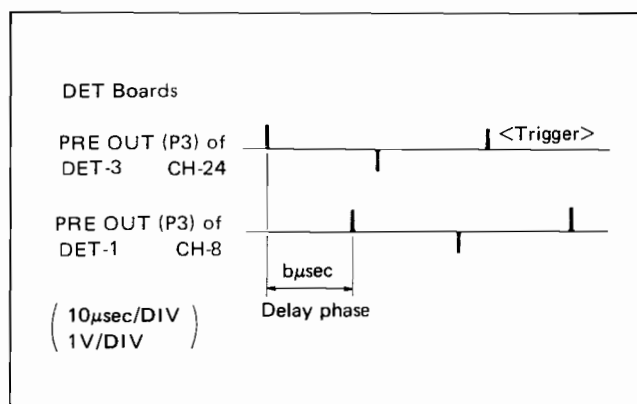


Fig. 5-2.

$$b - a = 30\mu\text{sec}$$

a: Azimuth correction amount of azimuth tape

Tightening of screw ④ (30μsec.)

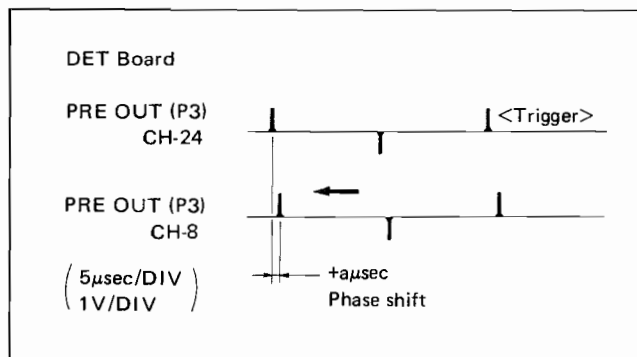


Fig. 5-3.

Azimuth tape

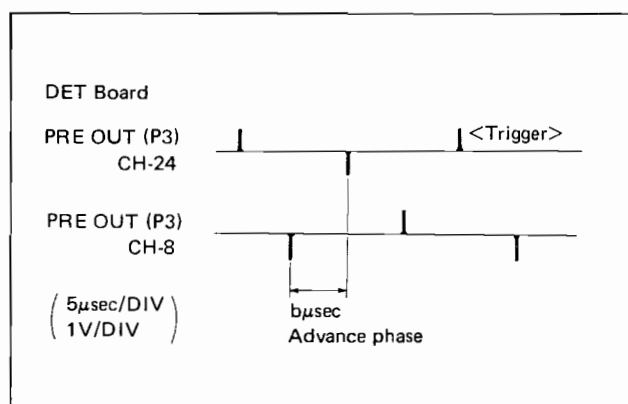


Fig. 5-5.

$$b + a = 40\mu\text{sec}$$

a: Azimuth correction amount of azimuth tape

Tightening of screw ④

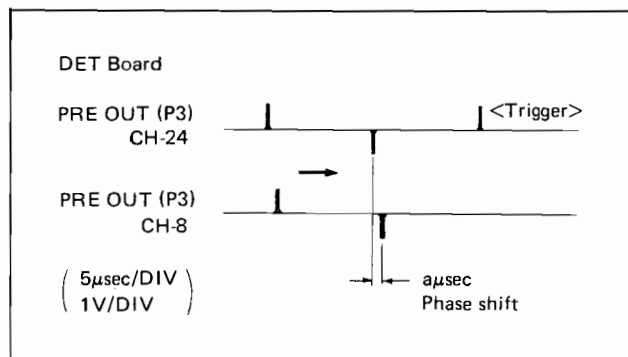


Fig. 5-6.

3) Azimuth adjustment of AE head

1. Insert the extension tool into CN6 of the HBU assembly and then insert CN6 of the analog harness into the extension tool (R).
2. Turn the screw 3 to adjust using the azimuth tape A. (Refer to Figs. 5-7 and 5-10.)
At this time, check that the tape is in parallel to the head core (as shown in Fig. 5-8).

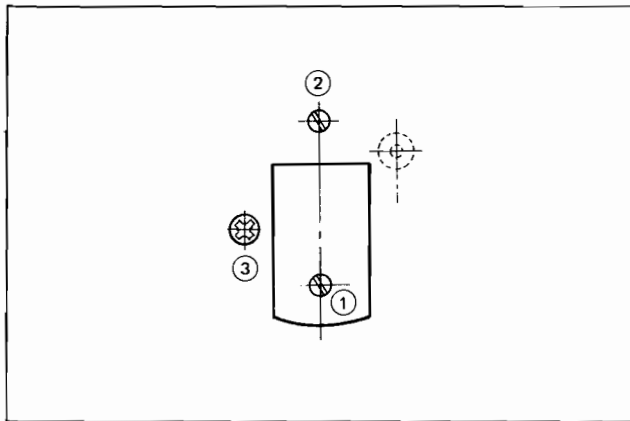


Fig. 5-7. Arrangement of AE head adjusting screw

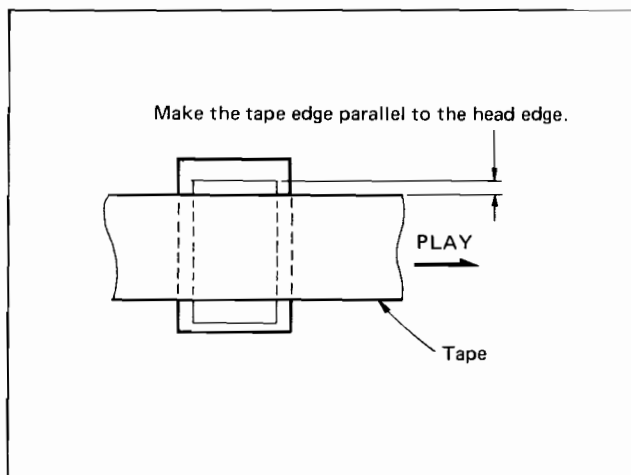


Fig. 5-8.

4) Azimuth adjustment of ARP head (Figs. 5-9 and 5-10)

1. Turn the screw ③ to adjust using the azimuth tape A. At this time, check that the tape is in parallel to the head core. (Refer to Fig. 5-8.)

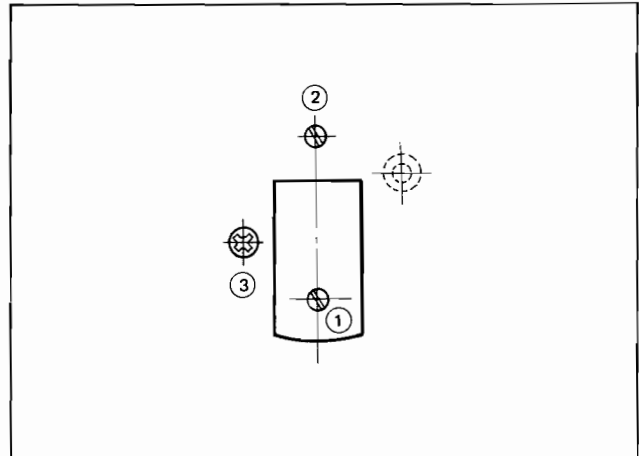


Fig. 5-9. Arrangement of ARP head adjusting screw

Azimuth tape

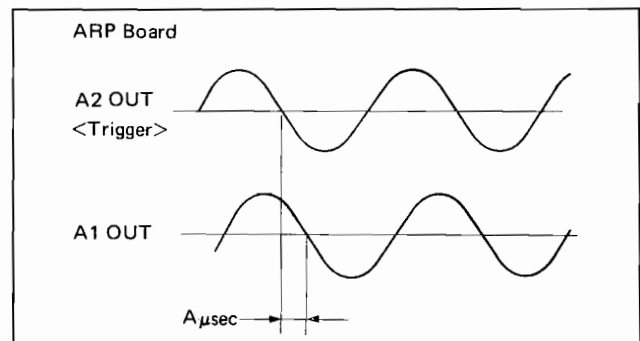


Fig. 5-10.

a: Azimuth correction amount of azimuth tape A

<2> Head contact check
Connection

	D/AD	D/PB	D/S	ARP	AE
HBU assembly	CN2	CN4	CN8	CN6	CN6
					Extension cable jig (R) and (L)
Narness	CN4	CN4	CN4	CN6	CN6
Output terminal	P3 terminal on DET-1 (RF output for CH8)			Analog outputs A1 and A2	

1) Check D/AD, D/S REC, and D/PB head contacts

1. Playback the contact adjustment tape.
(DIGITAL)
2. Weakly pressing the tape which is running in the left and right of the D/AD, D/S REC, and D/PB heads, check that the contact pressures meet the specifications. (Fig. 5-11.)

2) Check ARP head contact

1. Play back the A-azimuth adjustment tape.
(ANALOG)
2. Check the contact pressures in the same way as the D/AD, D/S REC and D/PB heads.
- 3) Check A/E head contact
 1. Check the contact pressures in the same way as the D/AD, D/S REC and D/PB heads.

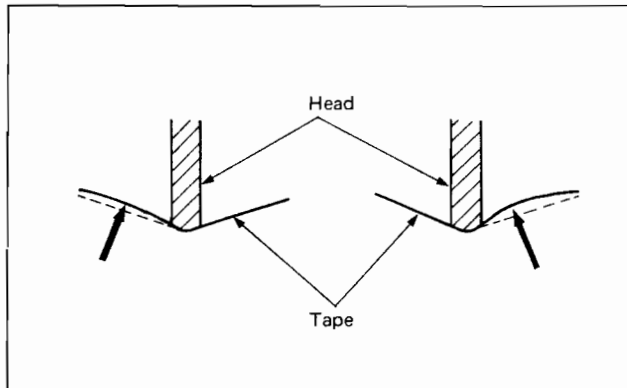


Fig. 5-11

The specifications define that the amplitude of the voltage waveform should be unchanged even if the tape is pressed.

<3> Tape running adjustment (FWD)

1) Timer roller height adjustment

1. Play back the reference tape for the tape running height.
2. Maximize the play-back level by using the timer roller height adjustment screw.
3. Check at the tape guide lower flange within the HBU that there are no clearance and curl. (Fig. 5-12).

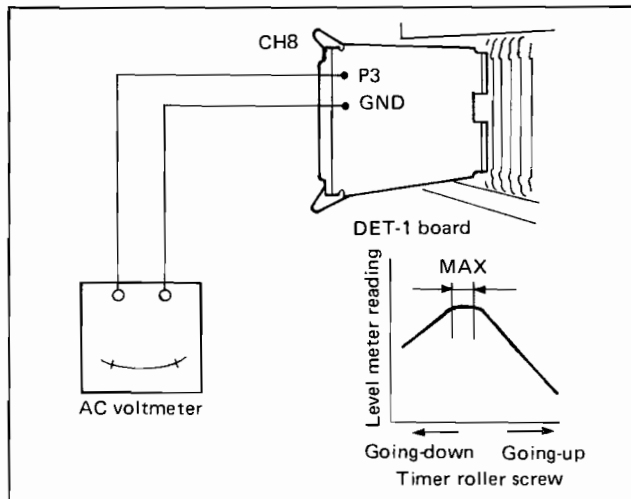


Fig. 5-12

2) S-tension roller height adjustment

1. Set the tape path adjustment tape and run it into the FWD direction.
2. Adjusting the S-tension roller height, set the tension roller so that there are no clearance and curl at the entrance (indicated by arrow) on the upper flange of the timer roller. (Fig. 5-13)

Note: Fasten the S-tension roller by using the setscrew after completion of S-tension roller height adjustment, and then perform the tape running check.

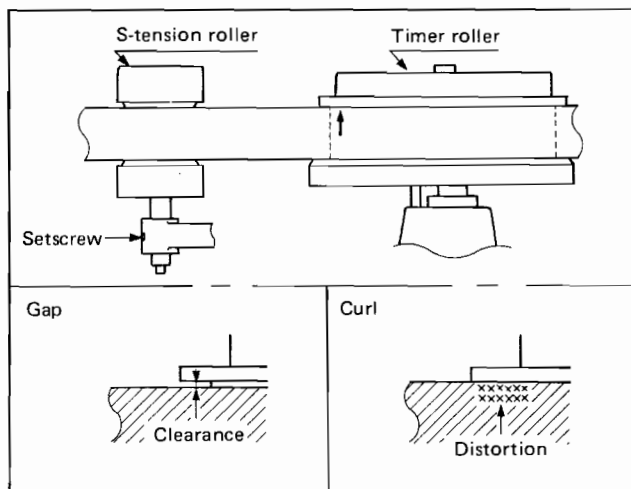


Fig. 5-13

3) S-guide roller height adjustment

1. Adjusting the S-guide roller height, set the S-guide roller so that there are no clearance and curl at the entrance (indicated by arrow) on the lower flange of the S-tension roller. (Fig. 5-14)

Note: Fasten the S-tension roller by using the setscrew after completion of S-tension roller height adjustment, and then perform the tape running check.

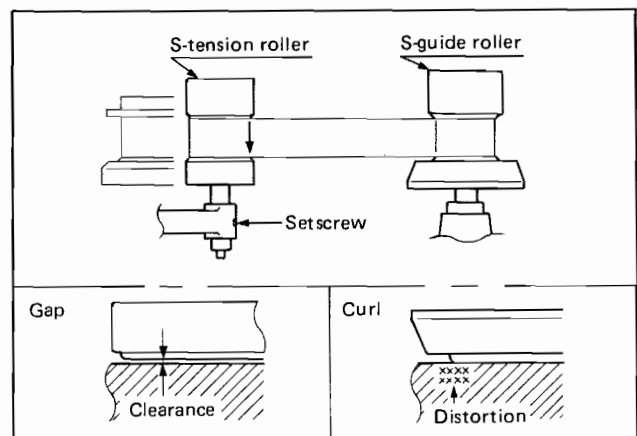


Fig. 5-14

4) T-tension roller height adjustment

1. Adjusting the T-tension roller height, set the T-tension roller so that there are no clearance and curl at the entrance (indicated by arrow) on the upper flange of the T-tension roller. (Fig. 5-15)

Note: Fasten the T-tension roller by using the setscrew after completion of T-tension roller height adjustment, and then perform the tape running check.

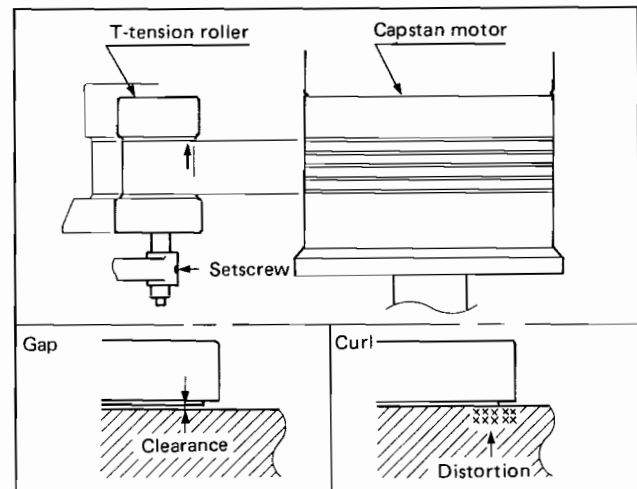


Fig. 5-15

5) T-guide roller height adjustment

1. Adjusting the T-guide roller height, set the T-guide roller so that there are no clearance and curl at the entrance (indicated by arrow) on the upper flange of the T-tension roller.
2. Check at the lower flange of the T-guide roller that there are no clearance and curl. (Fig. 5-16)

Note: Fasten the T-tension roller by using the setscrew after completion of T-tension roller height adjustment, and then perform the tape running check.

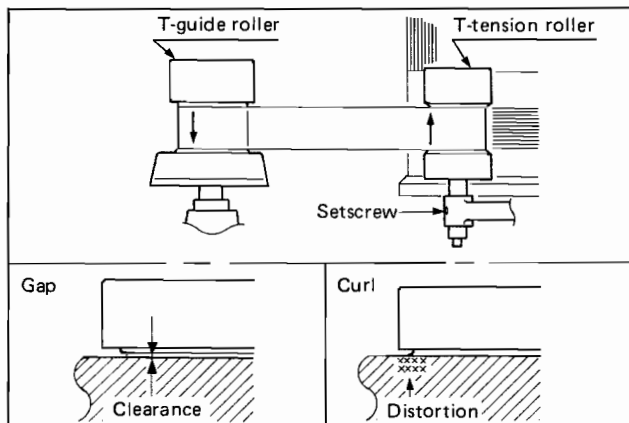


Fig. 5-16

6) reel mount height adjustment

1. Run the tape into the FF or REW direction by using the shuttle lever, and then loosen the two reel mount setscrews by using the hexagonal head wrench if the tape touches the supply/take-up reel during running.
2. Remove the cover setscrew, and then cause the reel height adjustment screw to go up or down by using the hexagonal head wrench. (Fig. 5-17)

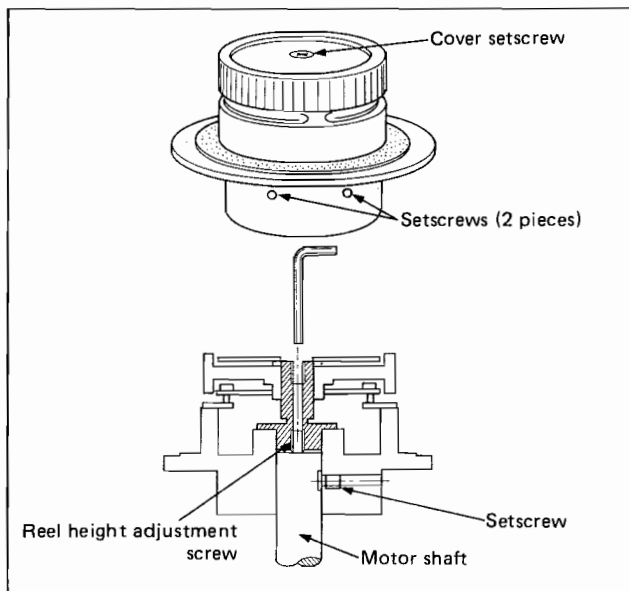


Fig. 5-17

<4> Tape running adjustment (FF and REW)

1) Confirmation

1. Press the tension disarm switch, and then the machine is set in the loading state.
2. Perform adjustment by inclining the tape shifter if the tape path can be changed by the tape shifter when the tape runs into the FWD or REW direction during shuttle lever operation.
3. Press **[FF]**, and then the tape runs forward at high speed.
4. Confirm that there are no clearance and tape curl when it runs passing through the G2-guide of HBU.
5. Confirm that there is no tape curl when it runs passing through the timer roller, S-tension roller, T-tension roller, S-guide roller, and T-guide roller (Fig. 5-13, 14, 15, 16).
6. Press **[REW]**.
7. Confirm that there are no clearance and tape curl when passing through the G2-guide of HBU.
8. Confirm that there is no tape curl when it runs passing through the timer roller, S-tension roller, T-tension roller, S-guide roller and T-guide roller. (Fig. 5-13, 14, 15, 16.)

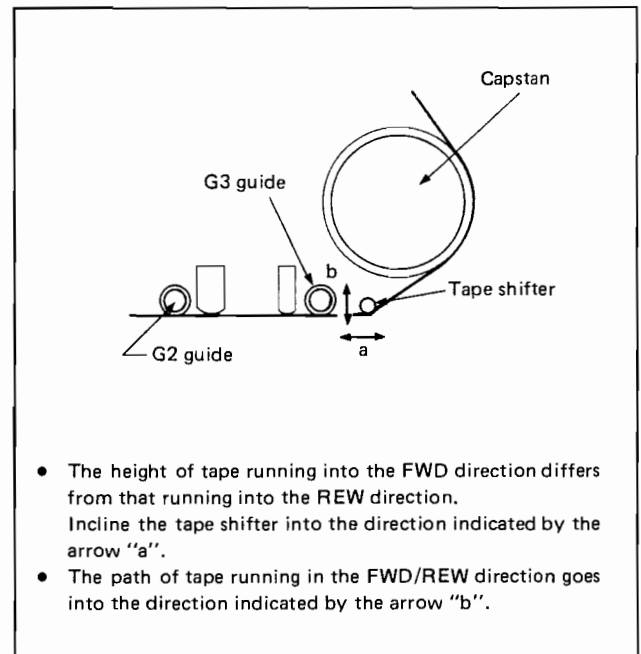


Fig. 5-18

<5> Head Adjustment (Head distance, Development, Height, and Azimuth adjustment)

1) Head distance adjustment (FS = 48kHz)

1. Adjustment of distance D/AD-REC ↔ D/PB (100 BLOCKS (19.01mm))

Check 1: The servo should be locked on the CTL board.

- Turn on the SW (4) on the ENC board. (4 BLOCKS) (Refer to Fig. 5-19.)

Check that the reference signal-2 lamp is on.

- Set to ADVANCE REC mode and adjust between the distance D/A-REC and D/PB.

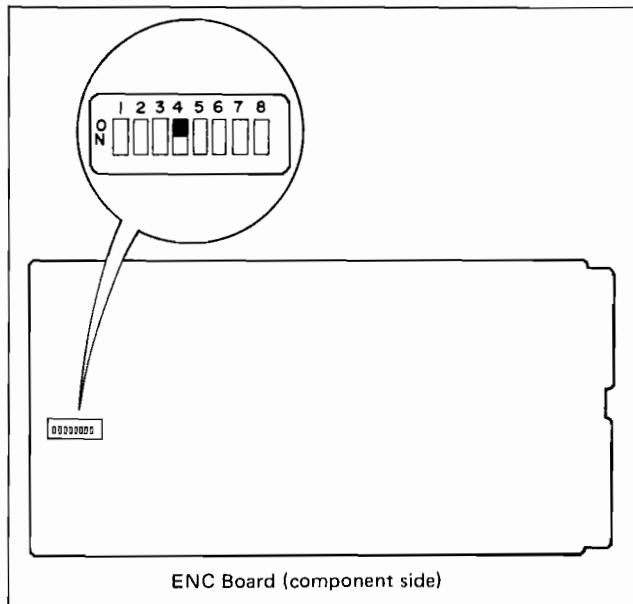


Fig. 5-19.

• Connection

	D/AD-REC	D/PB
Connector	CN-2	CN-4
Cable	2	4

(Refer to Fig. 5-20.)

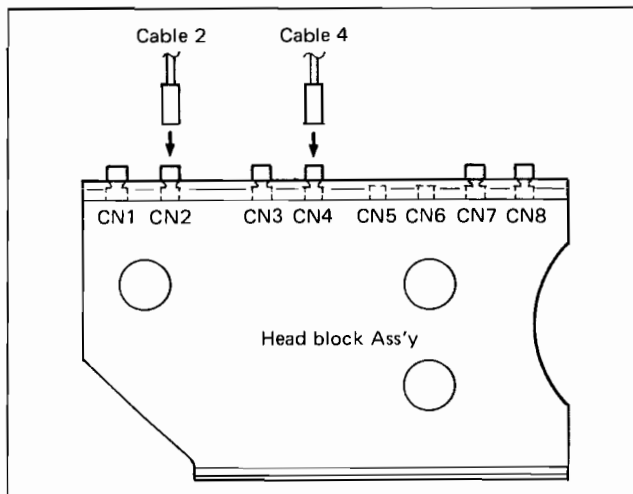


Fig. 5-20.

- Adjustment specification (0.25msec ↔ 1 BLOCK)

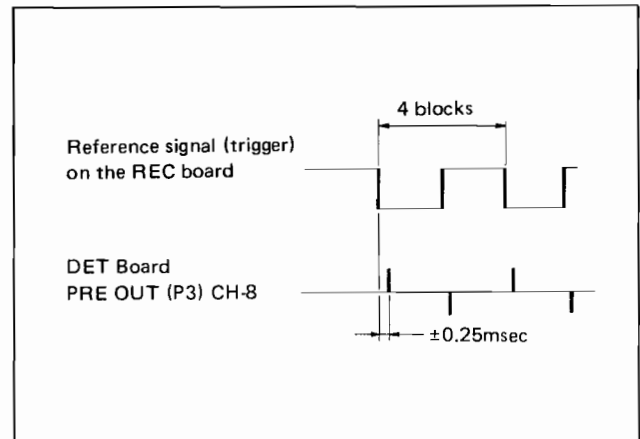


Fig. 5-21.

Connect an oscilloscope to pin 1 on the REC board. (Refer to Fig. 5-22.)

Note: Adjust at the inverted phase position.

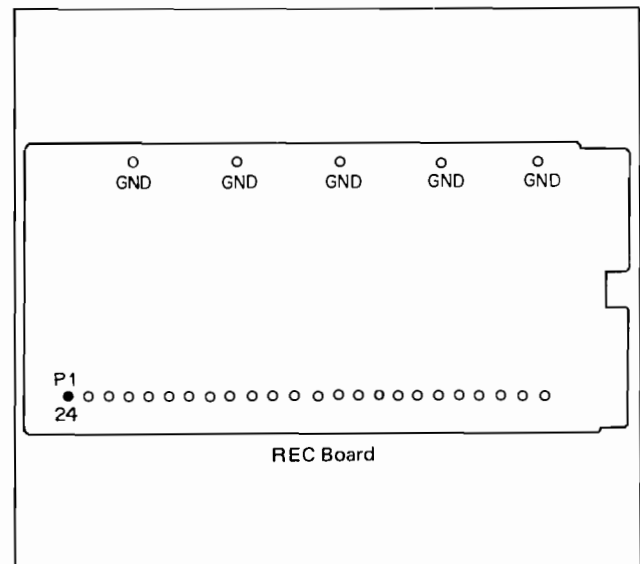


Fig. 5-22.

• Adjustment

- ① Tentatively tighten the two fixing screws (hexagonal head bolt, M2.6) of D/AD-REC Ass'y. (Refer to Fig. 5-23.)
- ② Move the head Ass'y from side to side using an eccentric screwdriver to meet the specification. Then tighten the fixing screws (hexagonal head bolt, M2.6) at 10kg-cm by using a torque screwdriver. (Refer to Fig. 5-23.) (Fix at 10kg-cm using a torque screwdriver.)
- ③ The head Ass'y may shift while tightening the screws, so check that its final position conforms to the specification.
- ④ When there has been a large shift due to error, use a jig (head distance alignment tape) to readjust the distance between the D/PB and D/AD-REC heads. (Refer to Fig. 5-23.)
Readjust the distance between the D/PB and D/AD-REC heads.

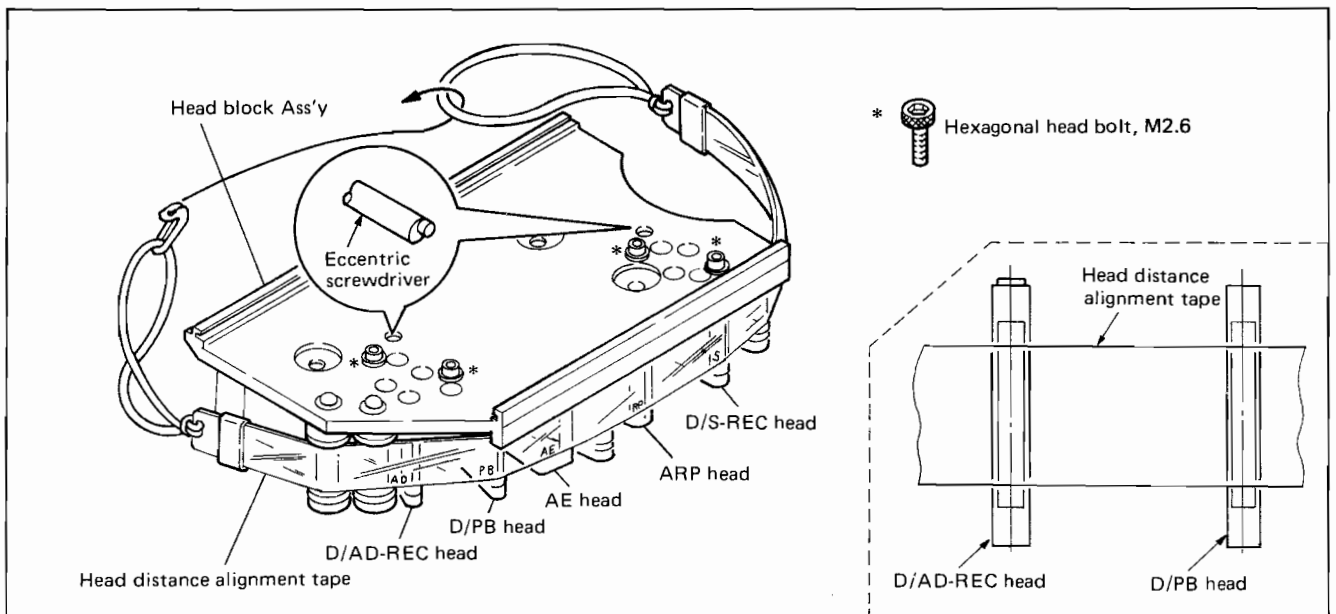


Fig. 5-23.

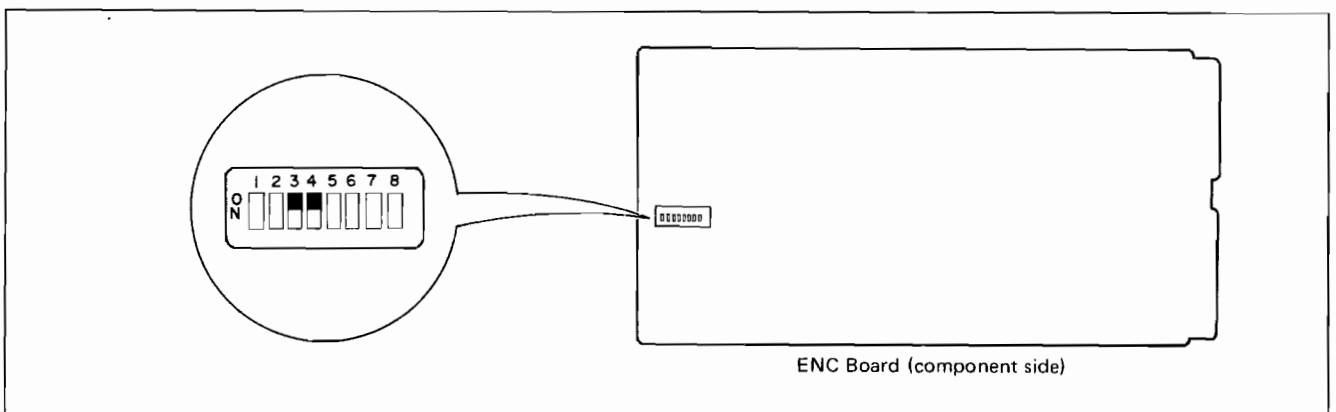


Fig. 5-24.

2. Adjustment of distance D/PB $\leftrightarrow$ D/S-REC (420 BLOCKS (80.01mm))
 - Set the switches (3) and (4) on the ENC board to ON. (28 blocks)
(Check that the lamp of reference signal-2 lights up.) (Refer to Fig. 5-24.)
 - Record/play back in the ADVACE REC mode and adjust between the distance D/PB and D/S-REC.
 - Connection

	D/PB	D/S-REC
Connector	CN-4	CN-8
Cable	2	4

(Refer to Fig. 5-25.)

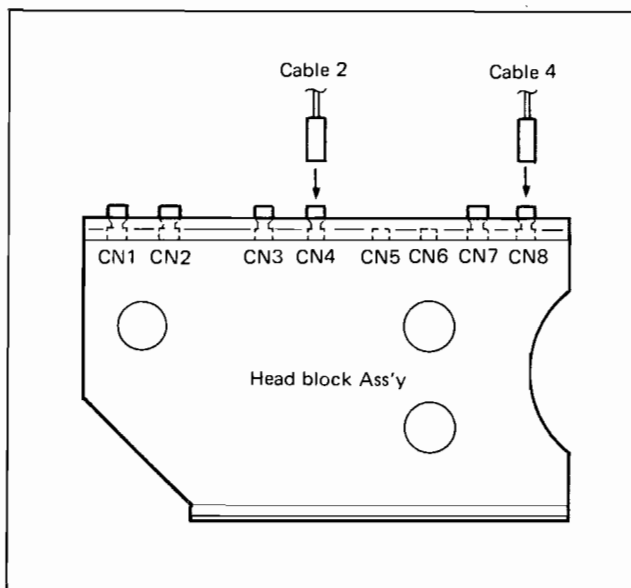


Fig. 5-25.

- Adjustment specification ($\pm 20\mu\text{sec.}$)

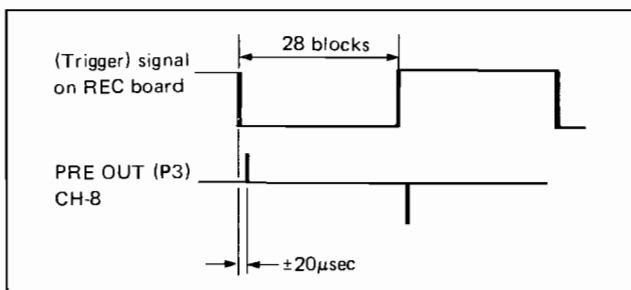


Fig. 5-26.

- Perform the adjustment in the same manner as for the D/AD-REC head.
(Refer to Fig. 5-23.)

- 2) Development of each head
 1. D head track pattern measurement
 - Connection

	D/AD		D/PB		D/S	
Connector	CN-1	CN-2	CN-3	CN-4	CN-7	CN-8
Cable	1	2	1	2	1	2

(Refer to Fig. 5-27.)

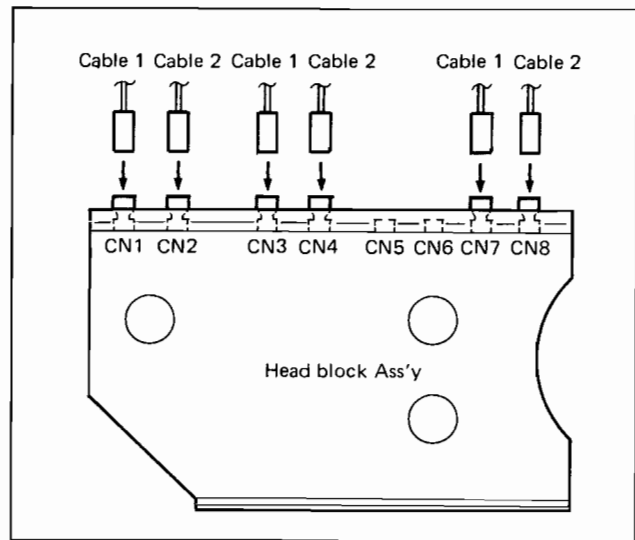


Fig. 5-27.

- Recorded signal
 - Set only the switch (3) on the ENC board to ON.
- Data
 - ① In the ADVACE REC mode, record onto the blank tape at all the channels for approx. 20sec.
 - ② Cut off a portion of the recorded tape (as shown in Fig. 5-28) and develop it.

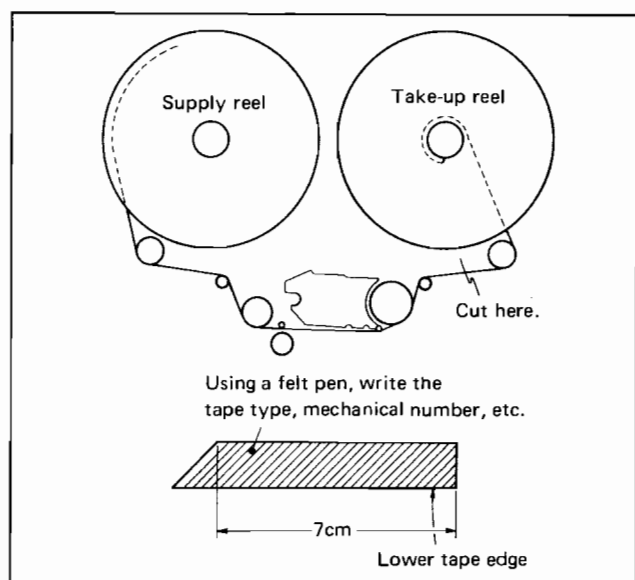


Fig. 5-28.

- ③ Cut off two tape samples and smear them uniformly with the developing solution by using a stick.
 - ④ Observe the distance, of one of the two tape samples, between the lower tape edge and each track edge under an optical microscope. (With one tape sample as a spare)
2. AE·ARP head track pattern measurement
- ① Select the select box (REC amp. jig) SWs of the AE (with right and left gaps) and ARP heads, respectively, to read the data as same as digital head (Refer to Fig. 5-29.)

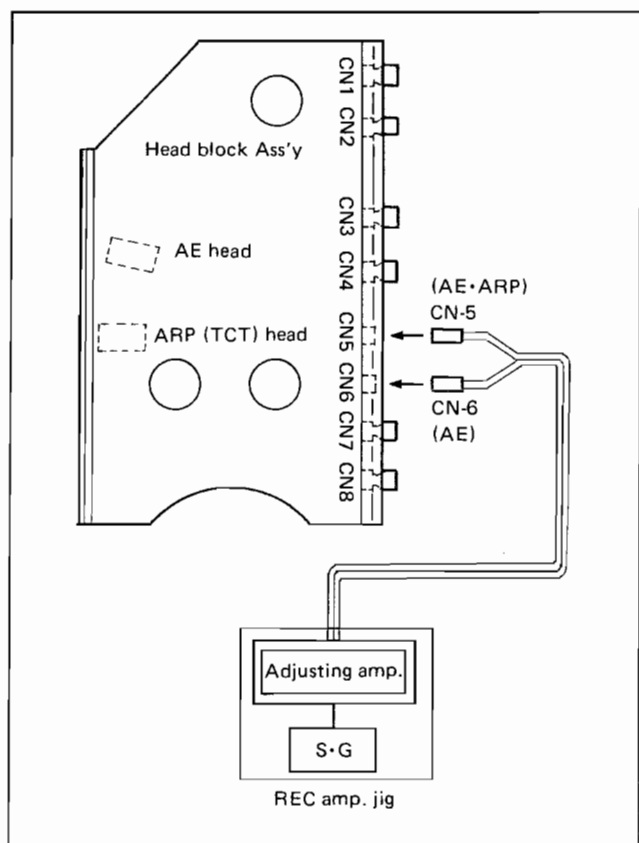


Fig. 5-29.

3. Calculation of correction amount of each head height
 - ① Referring to the head data added to the D head recorder, calculate the correction amount.
 - ② Calculate the correction amount so that each track edge of the A head meets the specification.
- 3) Fine-adjustment of head height and azimuth
 1. Perform a fine-adjustment in accordance with the correction amount of each head height in Step 2) described previously.

- D/AD-REC head adjustment (Use a fine-adjusting screwdriver for height.)

- ① For $X\mu\text{m}$ of correction amount, turn the head adjusting screws ① and ② (M3) by the same angle with a fine-adjusting screwdriver. (Refer to Fig. 5-17.)

$$\left(\times \frac{360}{500} \right)^\circ$$

When the value of X is,

- { - (minus) : turn counterclockwise.
- { + (plus) : turn clockwise.

Note: Be sure to loosen the screw ④ one time before turning the screws ① and ②. (Fig. 5-1, 4, 7, 9)

- ① Fine-adjustment of azimuth

Perform the fine-adjustment similarly to the azimuth adjustment in Step <1> described previously.

- ② Check after height fine-adjustment

Perform the developing process as previously described in Step 2).

Specification: Refer to the specification of the final adjustment.

- D/PB head adjustment

- ① Perform the fine-adjustment in the same manner as for the D/AD-REC head.
- ② The fine-adjustment of azimuth is also similar to the previous step.

Specification: Refer to the specification of the final adjustment.

- AE head adjustment

- ① Using a fine-adjusting screwdriver, make the correction in accordance with the correction amount required. (This correcting method is similar to that for digital head adjustment.)
- ② The check of height adjustment is similar to the previous step.

Specification: $\pm 0.045\text{mm}$ at the edge of all tracks.

- ARP head adjustment

- ① Perform the fine-adjustment in the same manner as for the D/AD-REC head.
- ② The fine-adjustment of azimuth is also performed in the same manner.
- ③ The check after height adjustment is also similar to the previous step.

Specification: ± 0.035 at the edge of all tracks.

- D/S-REC head adjustment

- ① This adjusting method is almost similar to that for D/AD-REC head adjustment.

Specification: Refer to the specification of the final adjustment.

- 4) Check of head distance adjustment

- 5) Check of head height and azimuth adjustments (when re-adjusted in the above 4))

*Final inspection specification

		D/AD	D/PB	AE (TCE)	ARP (TCT)	D/S
Head height	(Tape sample 1)	*	*	$\pm 45\mu\text{m}$	$\pm 35\mu\text{m}$	*
Head azimuth	In relation to reference tape (CH-8 ~ CH-24)	$\pm 5\mu\text{sec}$	$\pm 5\mu\text{sec}$	$\pm 20\mu\text{sec}$ (AE1 - AE2)	$\pm 65\mu\text{sec}$ (A1 - A2)	$\pm 5\mu\text{sec}$
Head distance						

The mark * is adjusted to the value shown in the data table of each head.

Reference dimension of analog track pattern

	each edge	distance mm
ARP	upper edge of A1	0.31
	lower edge of TCT	5.965
	upper edge of TCT	6.235
	lower edge of A2	12.33
AE	upper edge of AE1	0.37
	lower edge of TCE	5.9
	upper edge of TCE	6.3
	lower edge of AE2	12.27

<6> Electromagnetic conversion adjustment (REC/PB)

Note: As for record/playback operations, refer to Section 6 "Electrical Adjustment."

Procedure

- ARP: Refer to 6-2-2. (1) "PB Level Adjustment", 6-2-2. (2) "Bias Level Adjustment" and 6-2-2. (3) REC Level Adjustment.
- TCT: Refer to 6-4-3. canceled Amount Adjustment of Crosstalk of ARP to TCT.
- DIGITAL: Refer to 6-3-2. (1) "Setting the BIT SW on ENC Board to Test Mode", 6-3-2. (2) "Coarse Adjustment of Recording current (I)", 6-3-2. (3) "Coarse Adjustment of Recording current (II)" and 6-3-2. (5) "Adjustment of Offset".

(6) Confirmation and Check

1) Tape running check

1. Confirm that at the roller flange there is no curl in each of the FF, REW, and FWD modes, and also that at lower flange of the HBU tape guide there are no clearance and curl.

2) Tape shlip

1. Referring to 5-1-3. "Confirmation of Preset Tension", confirm that tape shlip is allowable.

3) Wow of tape during record/playback operation

1. Load the tape whose contents have been erased, set only the bit switch (3) on the ENC board to ON (2 blocks), and run the tape in the recording mode for 10 minutes. (Refer to Fig. 5-30.)
2. Rewind the tape and playback the tape.
3. Confirm that wow is less than the upper board listed below.

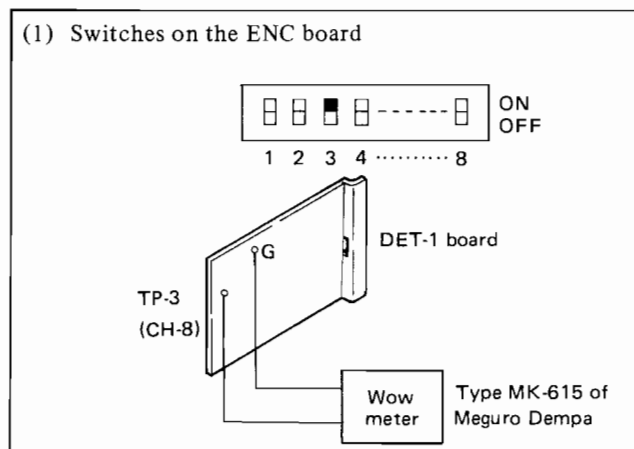


Fig. 5-30

Filter	0 to 200 Hz	0 to 20 kHz
Function	WTD	* EXT WTD
Wow	0.03% rms	0.2% p-p

Note: Measure EXT. WTD in the EXT mode after connecting TP-3 (CH-8) to the EXT. FILTER terminal of the wow meter. (Fig. 5-31)

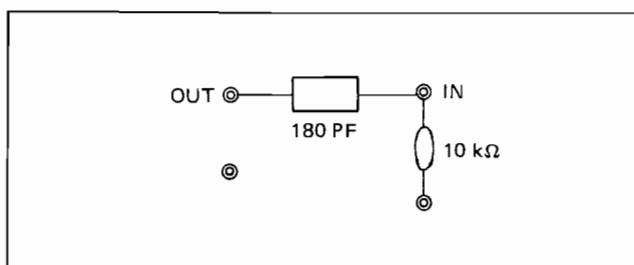


Fig. 5-31

4) Error rate check

1. Set the TEST/NORM switch on the EDT-B board to TEST, turn off the HPF switch, and turn on the dither switch.
2. Load the tape whose contents have been erased, and run the tape in the simultaneous record/playback mode of operation for 10 minutes.

(2) (Check of D/AD-REC and D/S-REC head distances)

Check if a specific channel lamp indicating the CRC errors on the TBC board does not light and also check if each channel lamp does not light periodically.

3. Perform the record operation in the same location as above using the analog A1/A2 channel.

(No program should be input during the record operation.) Then, rewind the tape and perform the playback operation.

(3) (Check of relative deviation of D and A heads)

Check if the CH1 or CH24 lamp indicating the CRC errors on the TBC board does not light.

4. Perform the assembly record operation in the same location as above, rewind the tape, and play back it.

(4) (Check of D/S-REC head height)

Check if a specific channel lamp indicating the CRC errors does not light and also check if each channel lamp does not light.

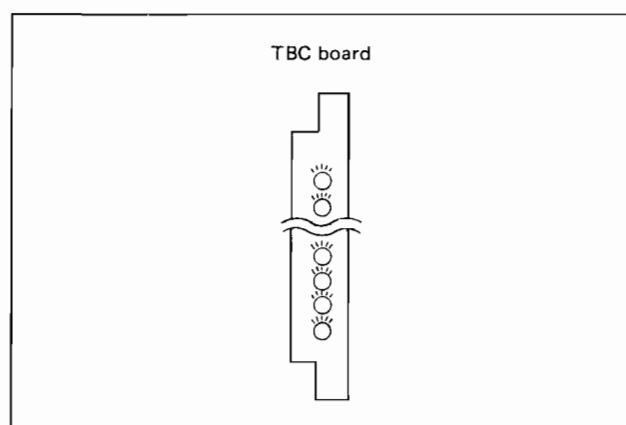


Fig. 5-32

5) Punch in/out

1. After connection, mount the tape whose contents have been erased. (Fig. 5-33)
2. Playback the tape where some contents have been recorded (or a music tape).

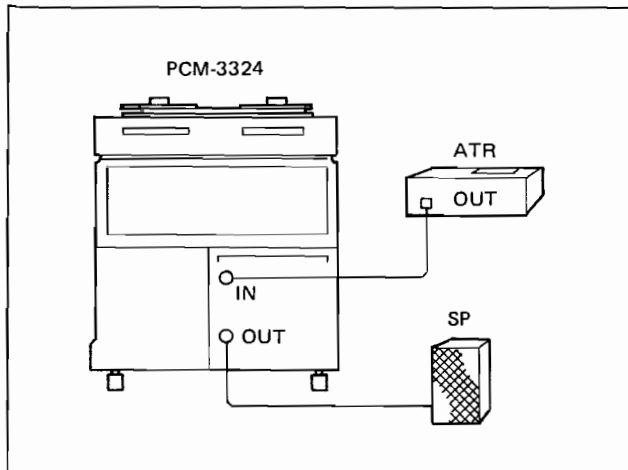
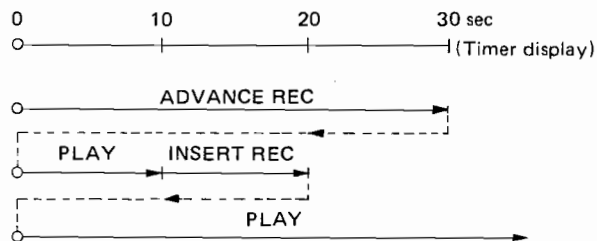


Fig. 5-33

3. Operate and check as follows:

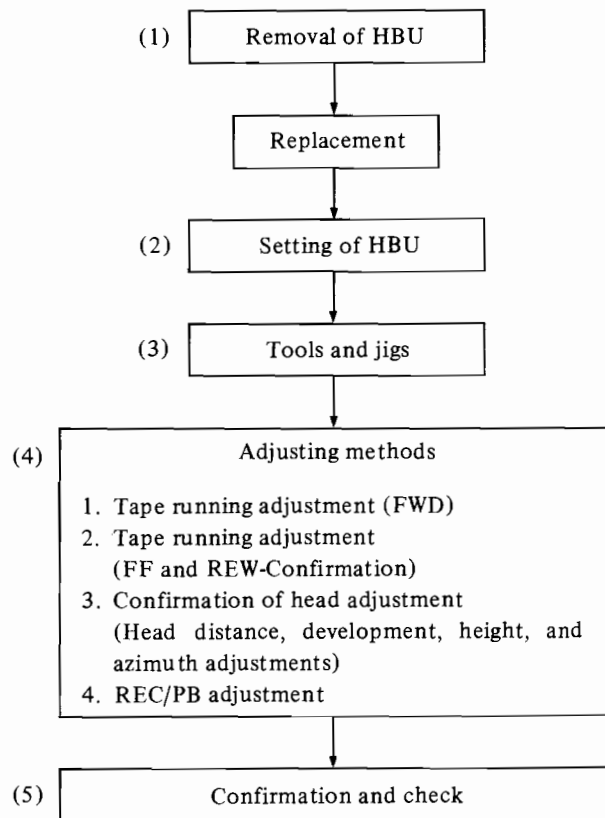


(Check)

- Check if the sound changes in 10 seconds after the start of the operation, if no CTL jump occurs, and if the MUTE lamp on the DCC board does not light.
- Check if the sound changes in 20 seconds after the start of the operation, if no CTL jump occurs, and if the MUTE lamp on the DCC board does not light.

5-6-2. Replacement of Blocks

• Configuration



- (1) Removal of HBU Refer to 5-6-1 (1).
- (2) Setting of HBU Refer to 5-6-1 (1).
- (3) Tools and jigs
 - ⊕ 4mm driver
 - ⊕ 4mm torque driver
- (4) Adjusting methods
 1. Tape running adjustment (FWD)
Refer to 5-6-1. (5)-<3>.
 2. Tape running adjustment (FF and REW)
Refer to 5-6-1. (5)-<4>.
 3. Confirmation of head adjustment
Check with reference to the inspection specification* of head adjustments (head distance, development, height and azimuth adjustments) in 5-6-1. (5)-<5>.
 4. REC/PB adjustment
Refer to 5-6-1. (5)-<6>.
- (5) Confirmation and check refer to 5-6-1. (6).

SECTION 6

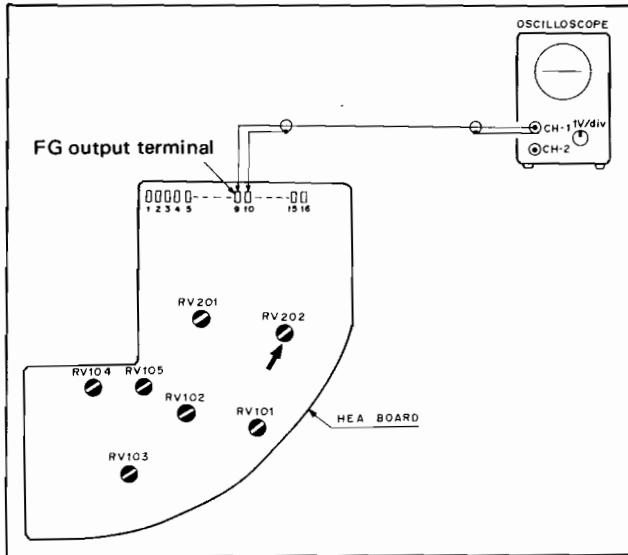
ELECTRICAL ADJUSTMENTS

- 6-1. Fine adjustment of servo
 - 6-1-1. Capstan FG level
 - 6-1-2. Capstan motor H.E Amp offset
 - 6-1-3. CTL PHASE adjustment
 - 6-1-4. Flutter adjustment
- 6-2. ARP board adjustment and overall adjustment
 - 6-2-1. Board adjustment
 - 6-2-2. Overall adjustment
- 6-3. Adjustment of the recording/playback system (DET board, REC board)
 - 6-3-1. Digital audio track playback system adjustment
 - 6-3-2. Digital audio track record current adjustment
 - 6-3-3. Adjustment of CTL track REC current
 - 6-3-4. Adjustment of CTL track PB level
 - 6-3-5. Confirmation of data track, CTL VARI PITCH MODE
- 6-4. TCT board adjustment
- 6-5. Items to be confirmed
 - 6-5-1. Confirmation of correcting ability
 - 6-5-2. Confirmation of PUNCH IN/OUT, and confirmation of splice edit
 - 6-5-3. Confirmation of indication and KBT functions in the operating system
 - 6-5-4. Confirmation of input/output (interface and peripheral units)
- 6-6. Check of A/D and D/A characteristics
 - 6-6-1. REC Audio Level Adjustment
 - 6-6-2. PB Audio Level Adjustment
 - 6-6-3. EMPHASIS Check
 - 6-6-4. A/D Conversion Offset Adjustment (AD Board)
 - 6-6-5. Noise Ratio Measurement
 - 6-6-6. Frequency Characteristic Measurement (1)
 - 6-6-7. Frequency Characteristic Measurement (2)
 - 6-6-8. Distortion Rate Measurement (1)
 - 6-6-9. Distortion Rate Measurement (2)

6-1. FINE-ADJUSTMENT OF SERVO

6-1-1. Capstan FG Level

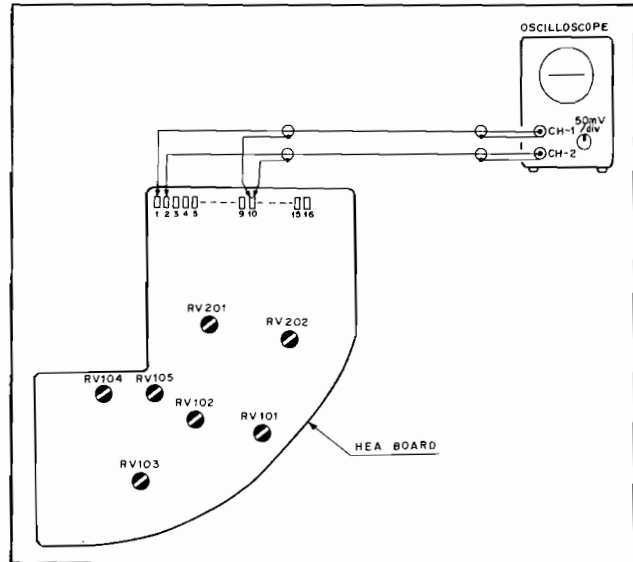
- (1) Connect the probe on the oscilloscope to 9-pin terminal on the HEA board.



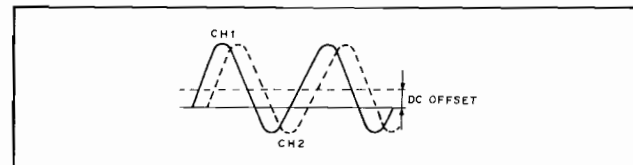
- (2) Put into ADVANCE REC mode and adjust RV202 so that the FG output is 4V PEAK (8 Vp-p).

6-1-2. Capstan Motor H.E Amp Offset

- (1) Connect the CH-1 probe on the oscilloscope to 1-pin terminal on the HEA board and the CH-2 probe to 2-pin terminal.



- (2) Put into STOP mode and adjust RV101 (CH-1) and RV103 (CH-2) so that the offset is 0 (± 5 mV or less).
- (3) When putting into FF mode and entering the steady state, adjust using the RV102 (CH-1) so that the DC offset of the waveform is 0. Adjust using the RV104 (CH-2) to the same state as in CH-1.



- (4) If the DC offset of the waveform does not appear during REW (steady state), no readjustment is required.
If it appears, readjust RV102 and RV104 so that the DC offset is minimized in FF/REW modes.
- (5) Put into PLAY REC mode and adjust RV105 (waveform balance) so that the waveform amplitude in the CH-1 is the same as that in the CH-2.

6-1-3. CTL PHASE Adjustment

- (1) Mount a tape on the unit (Use a new tape).
- (2) Set the reel servo to ON.
- (3) Put into PLAY REC (ADVANCE REC) mode.
- (4) Switch Fs to 48 kHz and center on the phase meter using the Gain RV (refer to note 1).

- (5) Switch Fs to 44.1 kHz and center on the phase meter using the Phase RV (refer to note 1).
- (6) Switch Fs back gain to 48 kHz, and check for centering on the Phase Meter. If not centered, repeat steps (4) and (5).

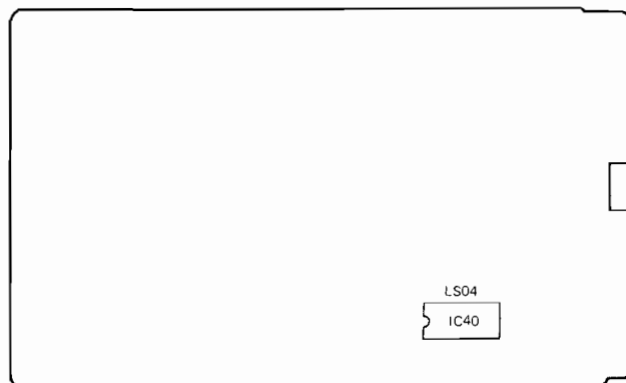
Note 1: The phase RV zeros the offset of the two FVC (FVD circuit) by means of the S & H OFF SET ADJ.

Note 2: Phase Gain RV means Phase Gain Balance. It makes the saw-tooth waveforms similar on the two FVC (FVD circuit).

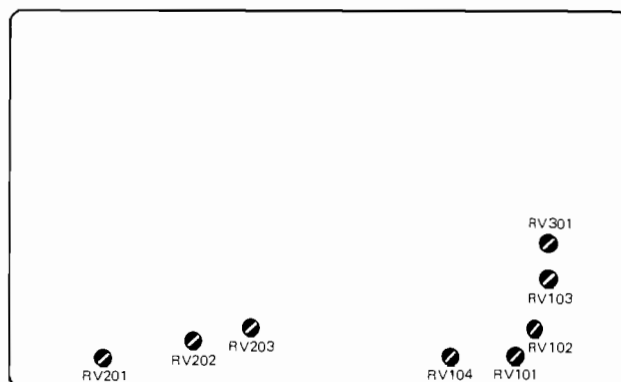
6-1-4. Flutter Adjustment

- (1) Connect the Wow-flutter Input to IC40 (LS04) pin 8 on the SERVO board (Grounding point is DE ϕ or IC40 (LS04) pin 7).
- (2) Set to REC (ADVANCE REC).
- (3) Adjust RV102, RV202, RV101, RV201 and RV104 on the DRV1 board and RV105 on the H.E. Amp board as shown in Fig. 6-1 so that the flutter reading on the meter is minimum (0.015% or less (UWTD, rms)). (In this case, the waveform balance in 6-1-2. may be lost.)

Note: Don't excessively turn RV101 and RV201 counterclockwise. Because the Amplifier will start oscillating.



SERVO BOARD (COMPONENT SIDE)



DRV1 BOARD (COMPONENT SIDE)

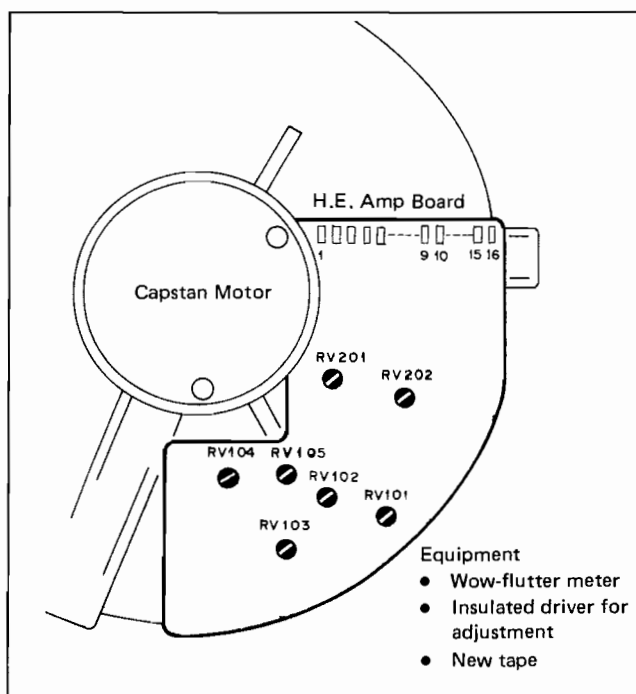


Fig. 6-1.

6-2. ARP BOARD ADJUSTMENT AND OVERALL ADJUSTMENT

6-2-1. Board Adjustment

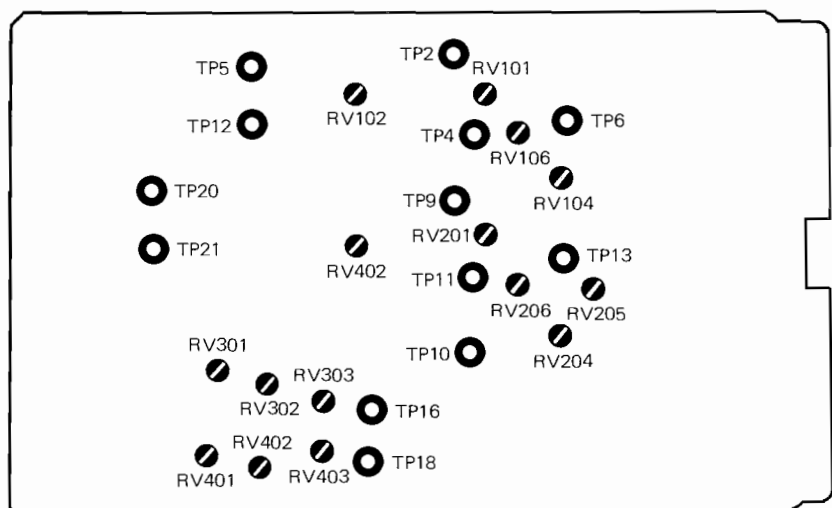
- (1) Input Balance Adjustment
Set the half-fixed knob of RV104 and RV204 to the center.
- (2) Output Balance Adjustment
Input 1 kHz +4 dBm, make TP3 [TP10] of the Line out Amp. 0 dB, and adjust RV102 [RV202] so that TP4 [TP11] is at the same level.
- (3) Output Level Adjustment
Keeping the input as in (2), and watching TP3 [TP10] and TP4 [TP11], adjust RV105 [RV205] so that the line output is +4 dBs.
- (4) Meter Amp Adjustment
Alternately adjust RV301 [RV401]: Meter Amp. Gain Adjustment and RV302 [RV402]: Meter Amp. Offset Adjustment so that the IC303 [IC403] output (PIN 6) is 3.6 Vdc when the input is 1 kHz +4 dBm; and the IC303 [IC403] output PIN 15 [PIN 17] is 1.00 Vdc when the input is 1 kHz -16 dBm [-20 dB down].
- (5) Meter Adjustment
Make the input +3.5 dBm [-0.5 dB] and adjust RV33 [RV43] so that 0 - 5V is obtained at R360 [R460] comparator out.
- (6) Bias Oscillator Output Adjustment
Adjust RV505 so that the Bias Oscillator Output (TP19) is 8 Vp-p.
- (7) Headphone Level Adjustment

6-2-2. Overall Adjustment

- (1) PB Level Adjustment
Observe the A₁ [A₂] output terminal or TP1, TP1-2 [TP2-1, TP2-2] and adjust RV11 [RV21] so that the line out is +9 dBm when the reference tape is used.
- (2) Bias Level Adjustment
Record 1 kHz +4 dBm as an input of A₁ IN (A₂ IN). Then, search a bias point at which the output at TP3 (TP10) is maximized in the PB mode by increasing gradually the bias value with RV507 (RV508). Set the bias value to a point at which the PB output is dropped by 6 dB as compared with that in maximum level by increasing further the bias value.
- (3) REC Level Adjustment
Record 1 kHz +4 dB as an input and adjust RV106 [RV206] so that the line out is +4 dB when reproduced. (only 1 kHz)
- (4) ERASE Current Adjustment
Record 1 kHz +20 dBm as an input. Then pull out the REC AMP. IC107 [IC207] and adjust RV501 [RV503] (60 - 70 dB) to erase the recorded input. Then insert IC107 [IC207] and adjust RV502 [RV504] so that the record/replay distortion is minimum.

CAUTION:

[] indicates the A₂ channel.

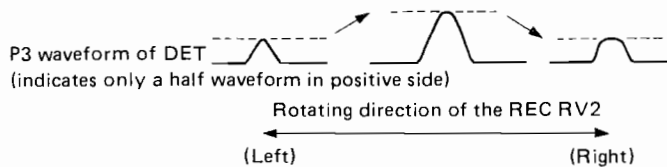


ARP BOARD (COMPONENT SIDE)

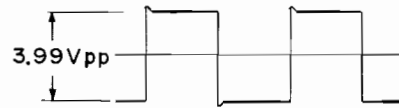
6-3. ADJUSTMENT OF THE RECORDING/PLAYBACK SYSTEM (DET BOARD, REC BOARD)

6-3-1. Digital Audio Track Recording Current Adjustment

- (1) Set to the TEST MODE (400 kHz square waveform) on the ENC board. Turn 1 and 2 of BIT SW of the ENC 1 to 3 at ON.
- (2) Pull out the REC board and the DET1 board (when adjusting of 1 to 8 CH) by using the EXT-D board.
- (3) Set only the CH-1 into REC mode with ADVANCE REC by using a standard recording tape (blank tape).
- (4) Rough Adjustment of Recording Current
Connect an oscilloscope to P3 in CH-1 of the DET, and adjust RV2 in CH-1 of the REC so that it will become to maximum level.



- (5) Fine Adjustment of Recording Current
Read the level of the output waveform by connecting an oscilloscope to P3 in CH-1 of the REC. (Example p-p 4.2V)
Observe the current characteristic value (indicated in %) of the standard recording tape, and if it is plus compared with 100% which is determined as the standard level, adjust the excess amount of the level to the minus side; and inversely, if it is minus, adjust the minus amount of the level to the plus side.
(Example: If the recording current characteristic value of the tape is 105%, subtract 5% from it. If it is p-p 4.2V in a rough adjustment, it should be lowered 0.21V at p-p value from $4.2 \times 0.05 = 0.21V$.

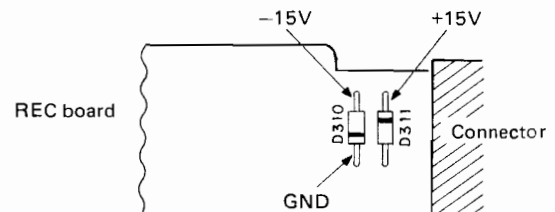


(Example) Peak to peak value of 4.2V in rough adjustment becomes 3.99V p-p when it is finely adjusted with the current characteristic value of 105%.

(6) Offset Adjustment

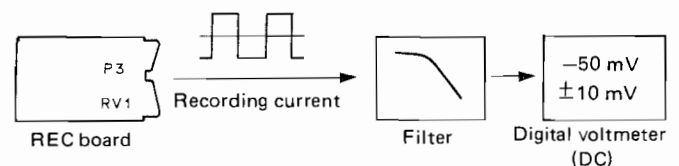
Remove the probe from pin 3 of REC CH-1, and connect the testing tools of the filter circuit (henceforth called filter) for offset adjustment, in place of the probe. (The filter should be connected in order to pick up the power supply voltage of $\pm 15V$ from the REC board when the power supply of PCM-3324 is turned OFF.)

If testing tools are not available, adjust the VR-1 so that both levels of the output waveforms of (+) and (-) of the oscilloscope become equal.

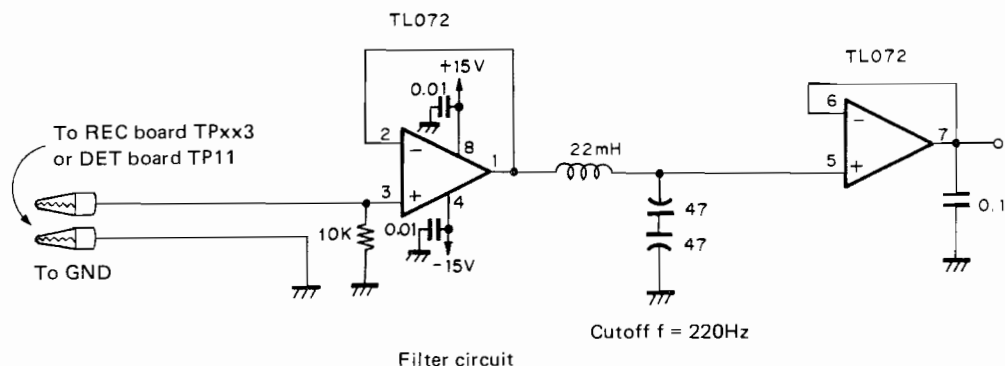


The place of $\pm 15V$ of the REC board from where the power supply voltage of the filter is picked up.

In the state of only the CH-1 of the ADVANCE REC is set into REC, measure the output of P3 of the REC CH-1 with a digital voltmeter through the filter, and adjust the RV1 of the REC CH-1 so that it will become $-50 mV \pm 10 mV$.

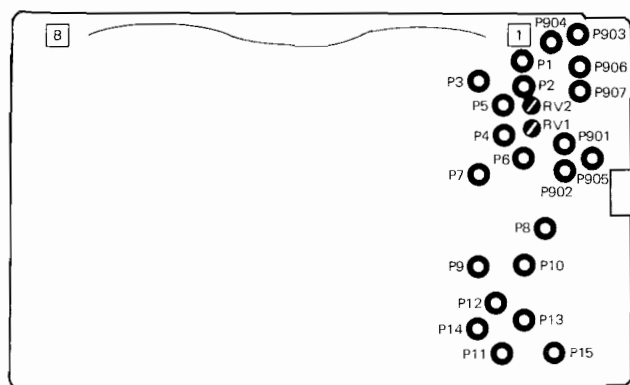


Testing tools (filter) circuit is as shown in diagram below.

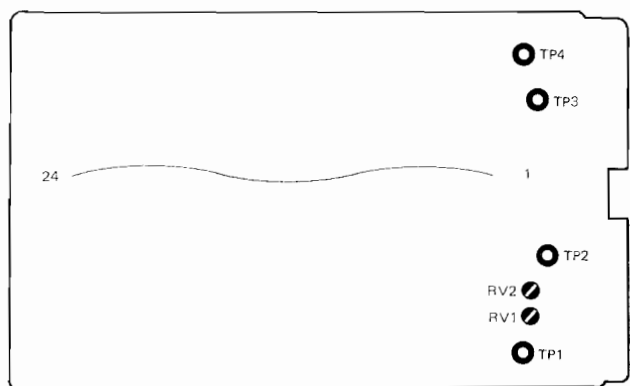


(7) Adjustment of 2 to 24 Channels

As for the 2 to 24 channels, set into REC mode only channels to be adjusted, and adjustments of the recording current and offsets should be performed at the respective test points and with volumes of the REC and DET.



DET BOARD (COMPONENT SIDE)



REC BOARD (COMPONENT SIDE)

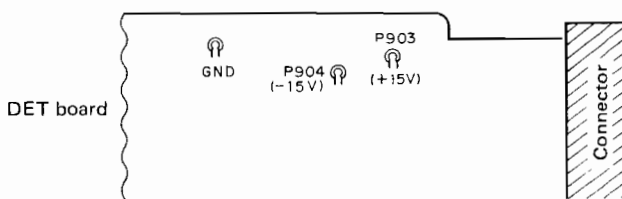
6-3-2. Adjustment of Recording Current of CTL Track

Set the recording mode into ADVANCE REC mode, and record CTL by using the standard recording tape (blank tape).

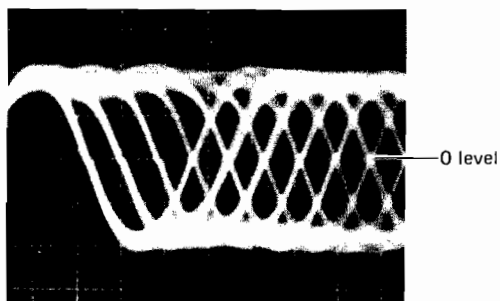
Connect the P3 of the CTL CH of the REC board to an oscilloscope at that time and adjust the recording current with RV2 so that it will become 4V p-p. Furthermore, connect the filter instead of the P3 of the oscilloscope, and measure the output voltage with the digital voltmeter, and adjust it with RV1 so that it will become $-50 \text{ mV} \pm 10 \text{ mV}$.

6-3-3. Digital Audio Track Playback System Adjustment

- (1) Clean the head, tape guide, etc. using a cleaning tip. Then demagnetize the head with a head eraser.
- (2) Pull out the DET board (when adjusting of 1 to 8 CH) by using the EXT-D board.
- (3) Turn BIT Switch of the ENC 1 to 3 back again into NORM mode, and draw the EDTB board out and switch PN GENERATOR to TEST side and turn DITHER ON (random pattern generation). Then return the EDTB board to the original position.
- (4) Connect power supply $\pm 15\text{V}$ of the filter to DET.



- (5) Set into ADVANCE REC and ALL CH REC. Use a standard recording tape.
- (6) Equalizer Adjustment
[It is a prerequisite that the adjustments of the recording current and offset have been performed properly.]
Connect an oscilloscope to P11 of CH-1, and adjust RV1 and RV2 so that the jitters of the eye pattern become minimum at the zero cross point. (See photos 1, 2, and 3.)



EYE pattern

- Adjusting procedure. Adjust RV1 and RV2 so that the waveform is as follows. (See photograph)

Adjust RV1 and RV2 alternately so as to minimize the jitter at the zero cross point. (To open the EYE pattern)

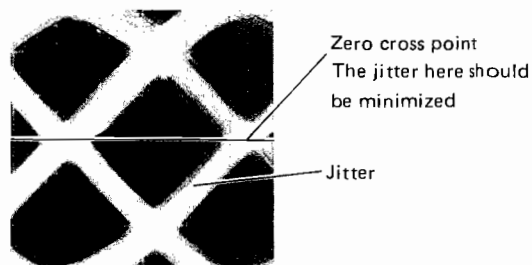
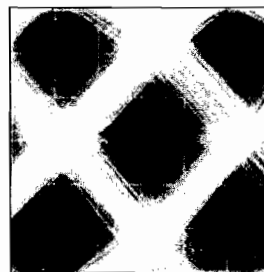
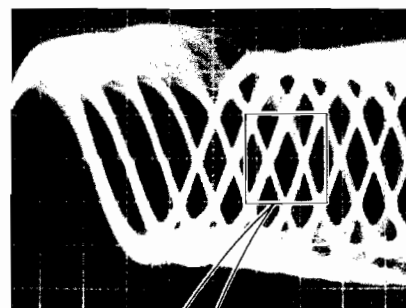
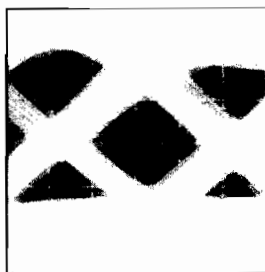
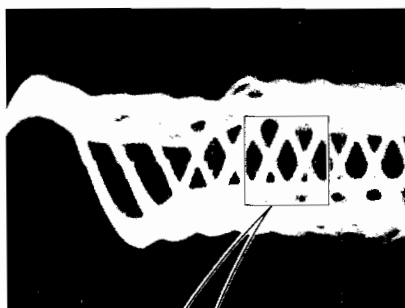
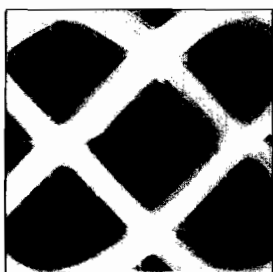
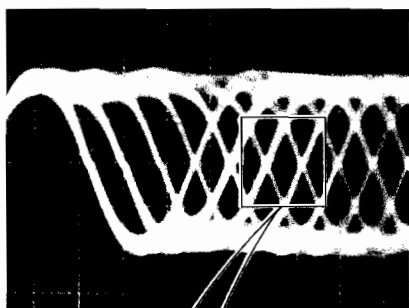


Photo 1 Equalizer Adjustment: Good

Photo 2 Equalizer Adjustment: Over-compensated

Photo 3 Equalizer Adjustment: Under-compensated



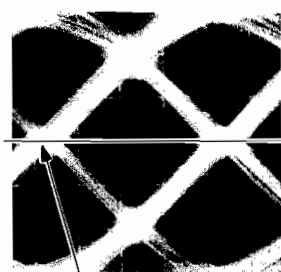
- (7) Disconnect the oscilloscope from P11 and connect the filter instead of it, and measure output of the filter by using the digital voltmeter. Then, adjust the offset amount of the eye pattern with VR (periphery of P11), so that it will become $+25 \text{ mV} \pm 10 \text{ mV}$. The indicated values of the digital voltmeter change rapidly at that time, so adjust the center of variation width so as to become $+25 \text{ mV}$.

- (8) Adjustment of 2 to 24 Channels

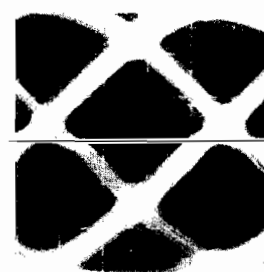
As for 2 to 24 channels, similarly as in 1CH, equalizer adjustment and offset adjustment should be performed with VR of the respective channels.

If testing tools are not available adjustment should be performed with VR (periphery of P11) so that it will coincide exactly at zero of the center of zero cross point of the output waveform of the oscilloscope.

Adjust so that the cross point is 0.



OK



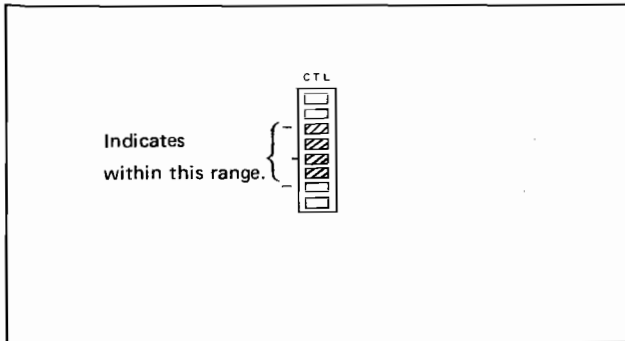
No Good

The third cross point from the left side

In case of adjusting the offset with an oscilloscope

6-3-4. Adjustment of CTL Track PB Level

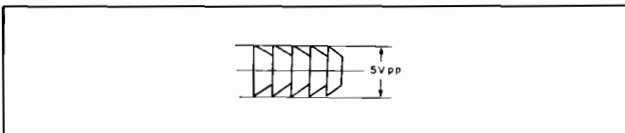
Adjust RV1 on the CTL board and set so that the CTL level meter indication is within the range of $0 + \frac{2}{-1}$ seg.



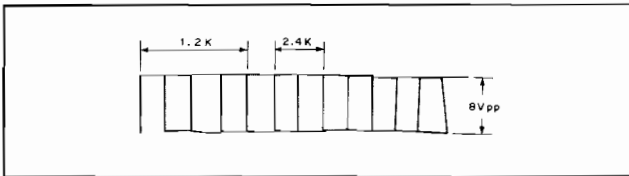
6-4. TCT BOARD ADJUSTMENT

6-4-1. During REC

- (1) Input SMPTE TIME CODE into TIME CODE INPUT.
- (2) Put into REC mode using a reference recording tape (live tape).
- (3) Connect the probe on the oscilloscope to TP102. Adjust RV101 so that the amplitude is 5 Vp-p.



- (4) Connect the probe on the oscilloscope to TP107. Adjust RV102 so that the offset is minimized.
- (5) By connection in Step (4), adjust RV103 so that the amplitude is 8 Vp-p.



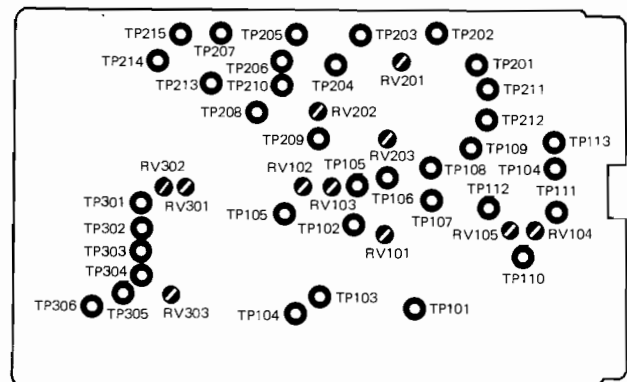
- (6) Connect the probe on the oscilloscope to TP301. Adjust RV301 so that the amplitude is 4 Vp-p.

6-4-2. During PB

- (1) Connect the probe on the oscilloscope to TP301. Play back the tape recorded and adjust RV201 so that the amplitude is 10 Vp-p.
- (2) Connect the probe on the oscilloscope to TP210. Adjust RV202 so that the amplitude is 2 Vp-p.
- (3) Connect the probe on the oscilloscope to TP212. Adjust RV203 so that the amplitude is 4 Vp-p.
- (4) Connect the probe on the oscilloscope to TP302. Adjust RV302 so that the amplitude is 4 Vp-p.
- (5) Adjust RV303 so that the level meter of TIME CODE indicates "0".

6-4-3. Canceled Amount Adjustment of Crosstalk of ARP to TCT

- (1) Set TCT to the REPRO mode and A1 (A2) to the REC mode.
- (2) At that time, connect the probe of an oscilloscope to TP206 on the TCT board. Adjust RV501 (RV502) so that the amplitude of the waveform is minimized.

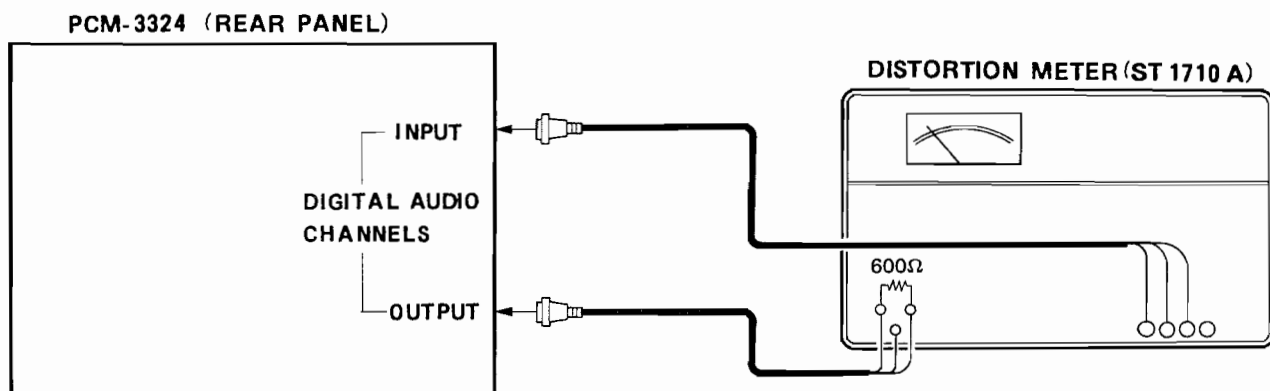


TCT BOARD (COMPONENT SIDE)

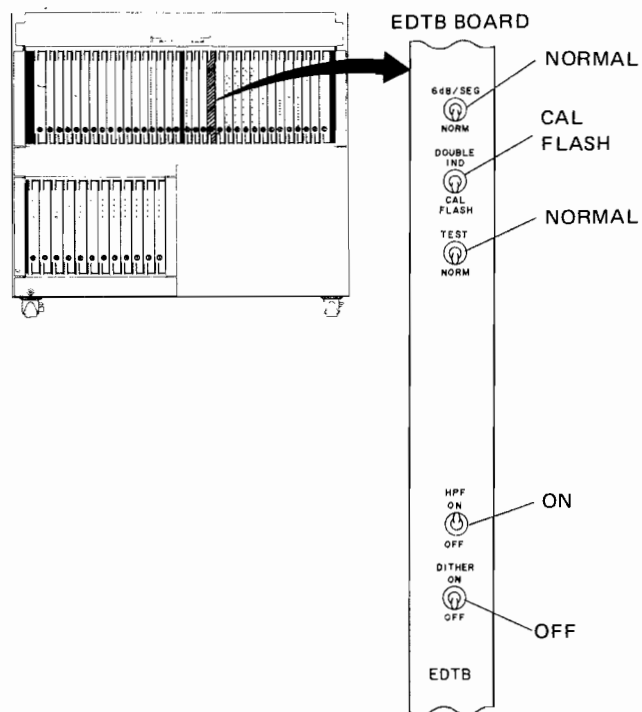
6-6. CHECK OF A/D AND D/A CHARACTERISTICS

Preparation

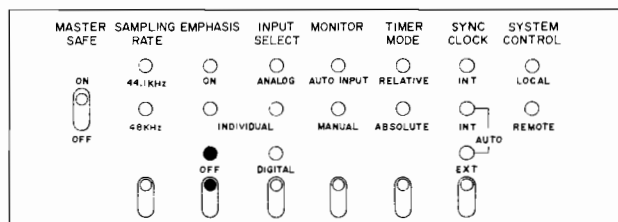
1. Turn the POWER SW of PCM-3324 on.
(Preset automatically to EMPHASIS ON ($f_s = 44.1\text{kHz}$).)
2. Depress the and keys on operation panel after approx. 10 seconds and set all channels to INPUT MODE.
3. Connect the DIGITAL AUDIO CHANNELS INPUT and OUTPUT terminals of the channel to be adjusted to the DISTORTION METER (ST17104).



4. Preset the SWs on the EDTB B to the positions shown below.

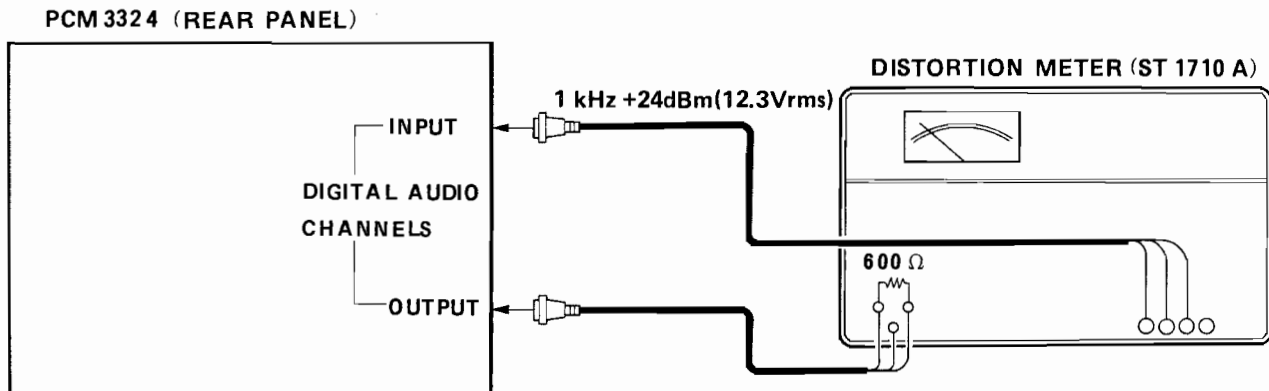


5. Turn the EMPHASIS SW on the TSW panel off.



6-6-1. REC Audio Level Adjustment

1. Connection



2. Adjustment

Adjust using the RVs 102, 302 and 402 on the AD board so that the uppermost LED of the level meter flashes.

Level Meter

Flashes (red)

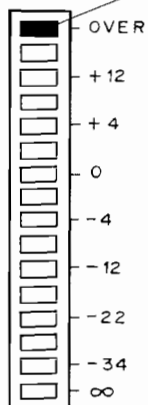
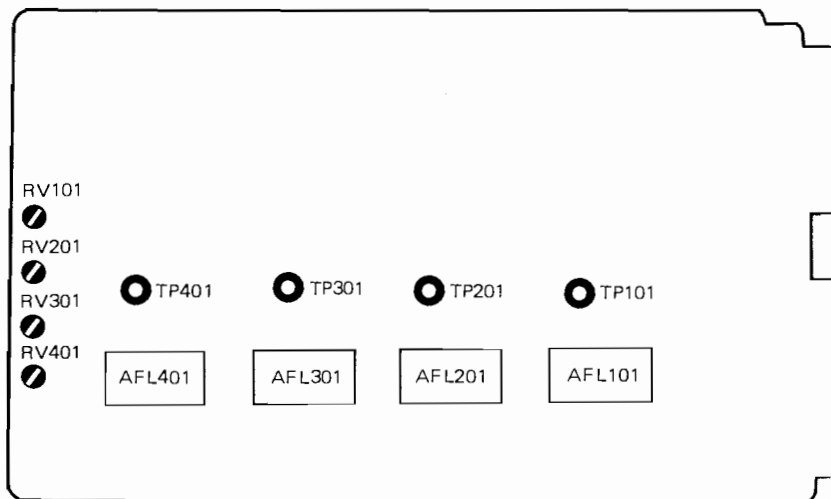


Table 1 Each Channel Corresponding to AD Boards

Gain adjustment VR Board	RV102	RV202	RV302	RV402
AD - 1	CH1	CH2	CH3	CH4
AD - 2	CH5	CH6	CH7	CH8
AD - 3	CH9	CH10	CH11	CH12
AD - 4	CH13	CH14	CH15	CH16
AD - 5	CH17	CH18	CH19	CH20
AD - 6	CH21	CH22	CH23	CH24

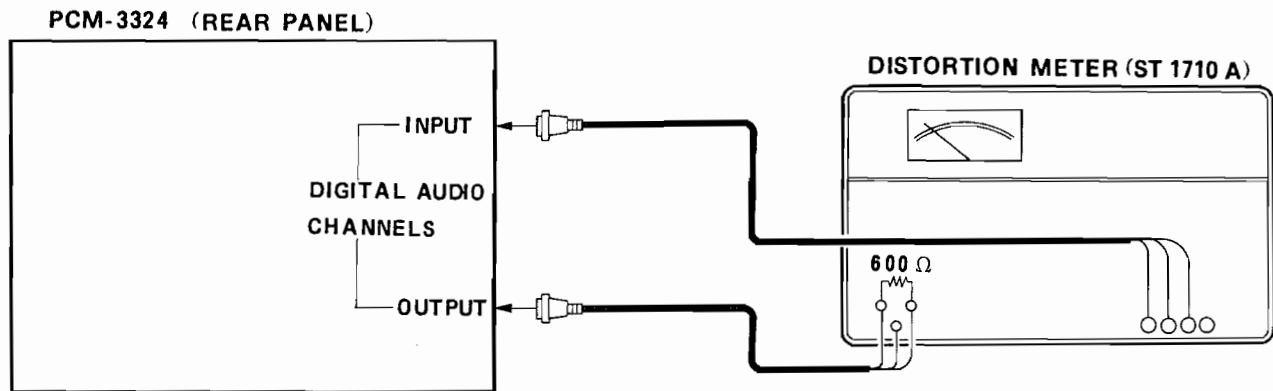
Adjustment Location: (COMPONENT SIDE)



AD BOARD (COMPONENT SIDE)

6-6-2. PB Audio Level Adjustment

1. Connection



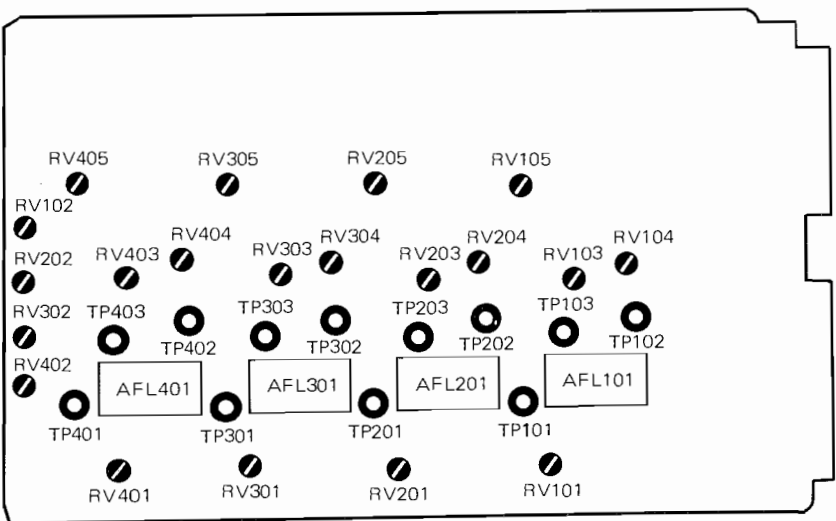
2. Adjustment

Adjust using the RVs 101, 201, 301 and 401 on the DA board so that the input of the level meter (ST1710A) is +24.0 dBm (12.30V rms).

Table 2 Each Channel corresponding to DA boards.

Gain adjustment VR Board	RV101	RV201	RV301	RV401
DA - 1	CH1	CH2	CH3	CH4
DA - 2	CH5	CH6	CH7	CH8
DA - 3	CH9	CH10	CH11	CH12
DA - 4	CH13	CH14	CH15	CH16
DA - 5	CH17	CH18	CH19	CH20
DA - 6	CH21	CH22	CH23	CH24

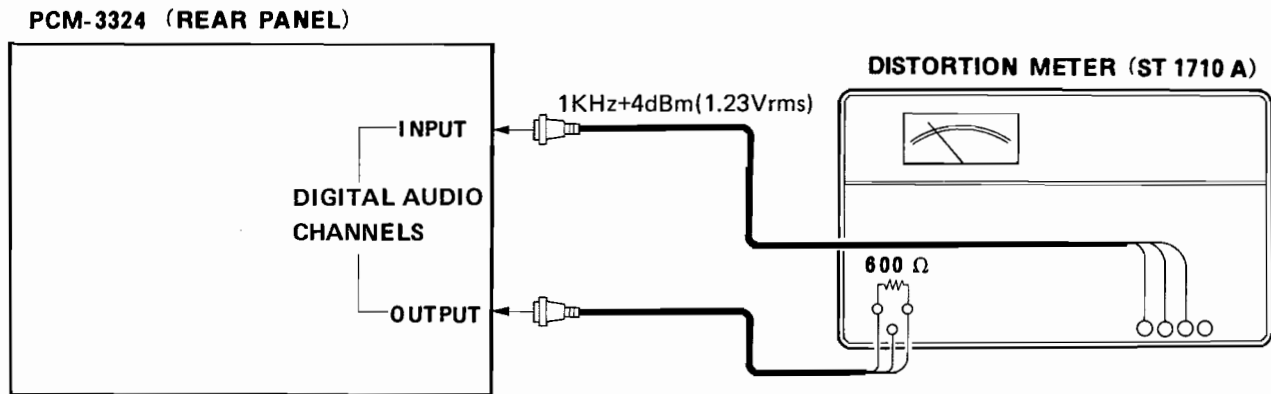
Adjustment Location:



DA BOARD (COMPONENT SIDE)

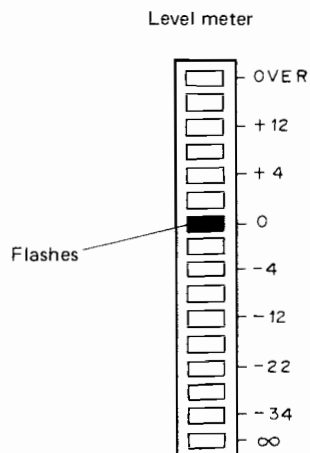
6-6-3. EMPHASIS Check

1. Connection



2. Adjustment

- (1) Check that the LED (green) of level meter flashes at the position.



- (2) Check that the level meter indicates +4.0 dBm.
- (3) Convert the frequency from 1 kHz to 10 kHz.
- (4) Check that the level meter indication is within the range of +3.0 to +4.5 dBm.
- (5) Depress the EMPHASIS SW on the TSW panel once and set to EMPHASIS ON.
- (6) Check that the LED (green) of the level meter rises up to the +4 position.
(In this case, check that the level meter indication is within the range of +3.0 to +4.5 dBm.)

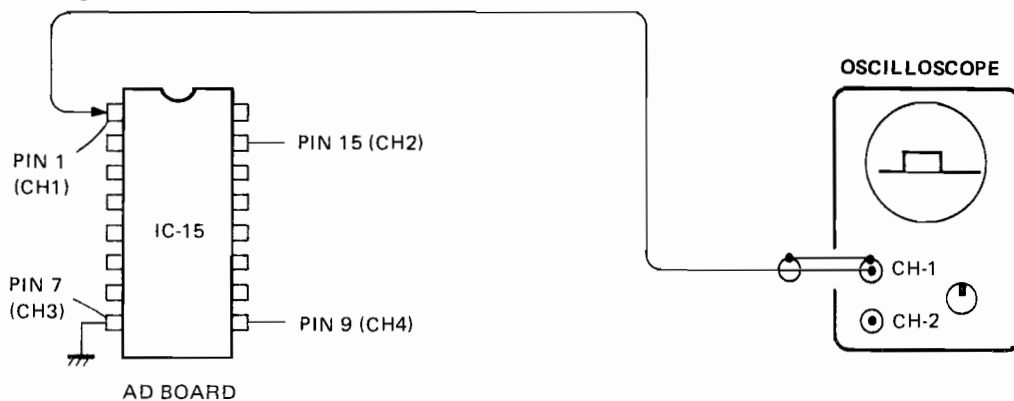
6-6-4. A/D Conversion Offset Adjustment (AD Board)

1. Connection

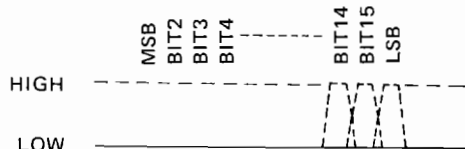
No connection (Rear Panel) or, signal OFF of ST 1710A

2. Adjustment

- (1) Connect the oscilloscope to AD Board IC15 (Arm 26CS31) pin 1 for CH1 (pin 15 for CH2, pin 7 for CH3 and pin 9 for CH4)



- (2) By referring to the waveform on the oscilloscope, adjust the offset VR on the AD board RV1035 for CH1 (RV203 for CH2, RV303 for CH3, and RV403 for CH4) so that the offset is zero.



Adjust MSB through LSB to "LOW".

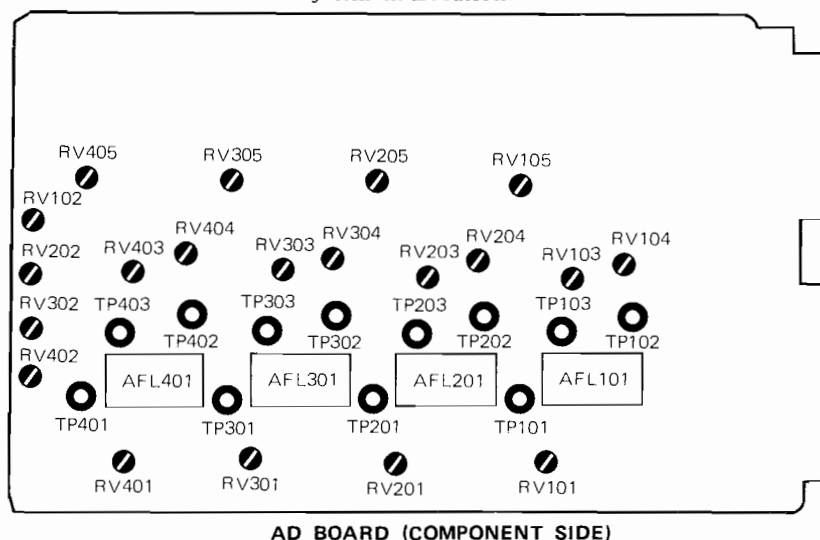
However, from BIT 14 through LSB can be HIGH or LOW depending on the noise.

Adjust CH5 ~ 24CH in the same way.

Table 3 Each Channel corresponding to AD boards

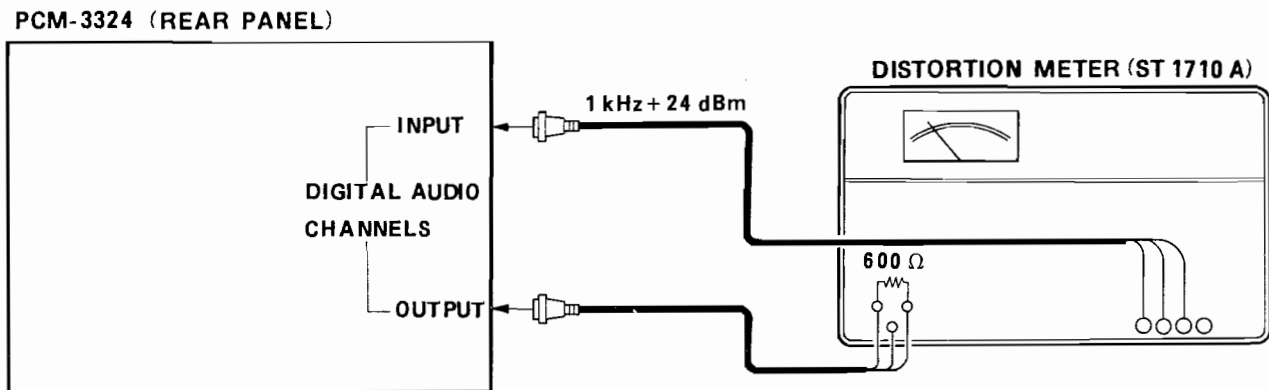
OFF SET VR Board	RV103	RV203	RV303	RV403
AD - 1	CH1	CH2	CH3	CH4
AD - 2	CH5	CH6	CH7	CH8
AD - 3	CH9	CH10	CH11	CH12
AD - 4	CH13	CH14	CH15	CH16
AD - 5	CH17	CH18	CH19	CH20
AD - 6	CH21	CH22	CH23	CH24

Adjustment Location:



6-6-5. Noise Ratio Measurement

1. Connection



2. Operation Process

- 1) Turn ON the EMPHASIS SW IN on the TSW PANNEL.
- 2) Input 1 kHz +24 dB to ANALOG IN, and make sure that the output from ANALOG OUT is +24 dBm. Then, turn OFF the oscillatr output, and measure the level at ANALOG OUT.
- 3) Calculate the value obtained by adding +24 dB to the noise level as a noise ratio. It should be 90 dB or more. (Measured at 30 kHz through LPF ON.)
- 4) Repeat the same measurement (2 ~ 3 above) to CH24.

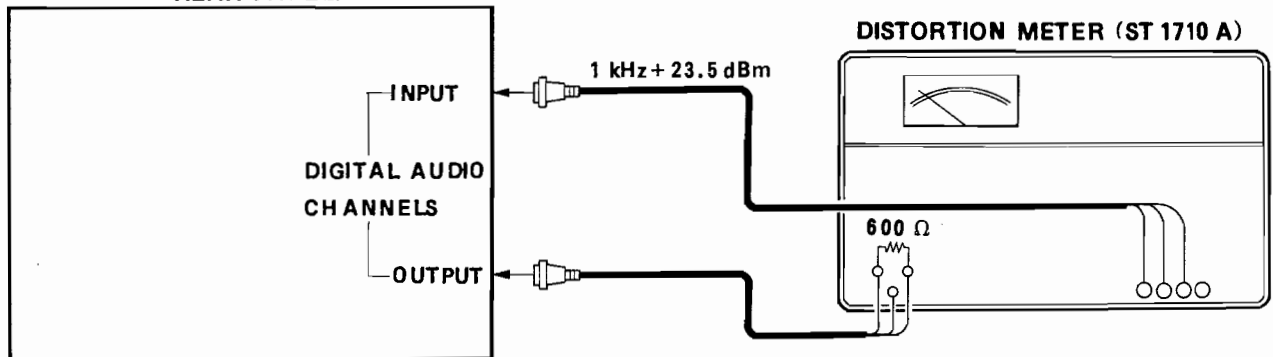
Specification

90 dB or more.

6-6-6. Frequency Characteristic Measurement (1)

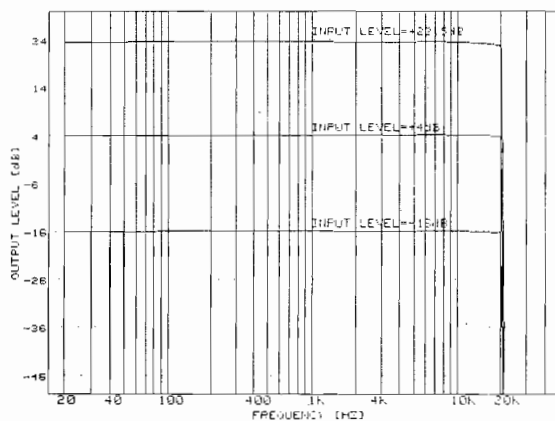
1. Connection

PCM-3324 (REAR PANEL)



2. Operation Process

- 1) TURN OFF the EMPHASIS SW IN on the TSW PANEL.
- 2) Input 1 kHz +23.5 dBm to ANALOG IN, and measure the level at ANALOG OUT.
- 3) Change the frequency of the oscillator to 20 Hz, 100 Hz, 4 kHz, 10 kHz, 19 kHz and 20 kHz in turn, and measure the output level corresponding to each frequency in the same way.
- 4) Make a graph of output level corresponding to each frequency.
- 5) Change the output level of the oscillator to +4 dBm and -16 dBm, and repeat measurements (2 ~ 4) above for each level.
- 6) Measure CH2 to 24 in the same way.



Specification

For input levels of +23.5 dB and -16 dB.

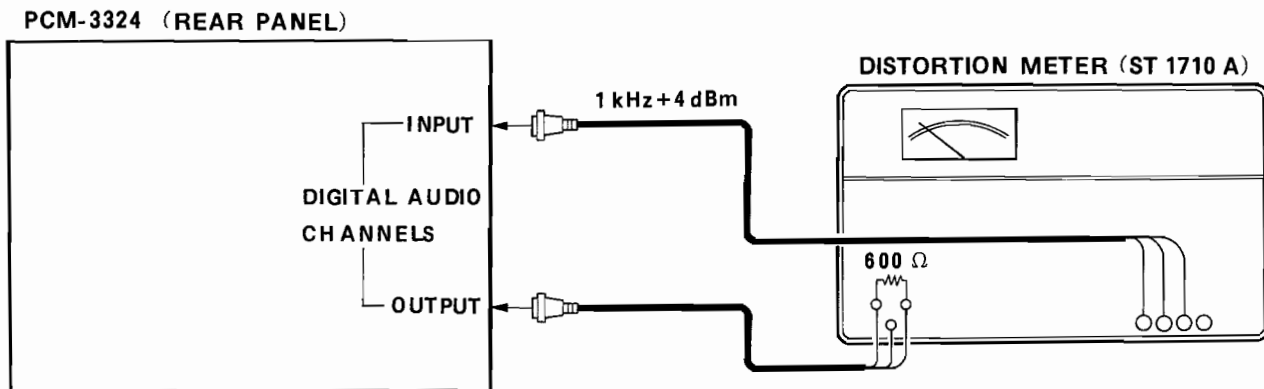
Frequency range: 20 Hz to 20 kHz in 1 kHz steps.

Output level variation with frequency should be with +0.5 dB.

-1.0

6-6-7. Frequency Characteristic Measurement (2)

1. Connections



2. Operation Process

- 1) Turn ON the Emphasis SW on the TSW Panel.
- 2) Input 1 kHz +4 dBm to ANALOG IN, and measure the level at ANALOG OUT with the level meter. Specify this level as "0". Change the frequency of the oscillator in turn, and measure the level at each frequency against 1 kHz as reference.
- 3) Frequencies: 20 Hz, 40 Hz, 100 Hz, 400 Hz, 4 kHz, 7 kHz, 9 kHz, 10 kHz, 12 kHz, 15 kHz, 17 kHz, 19 kHz, 20 kHz, 20.4 kHz.
- 4) Measure CH2 to 24 in the same way.
- 5) Record the data on the data sheet.

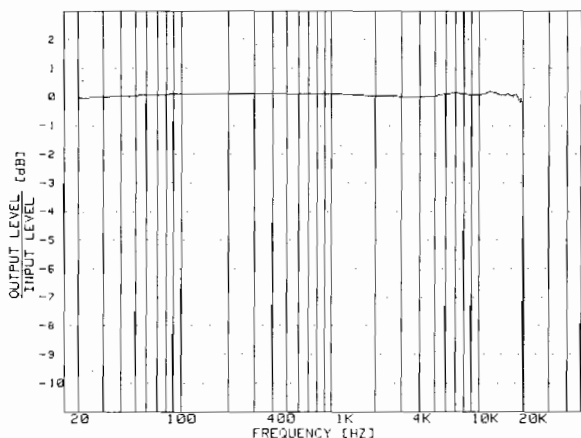
Specification

Against 1 kHz as reference.

20 Hz ~ 20 kHz: Within $+0.5$ dB
 -1.0 dB

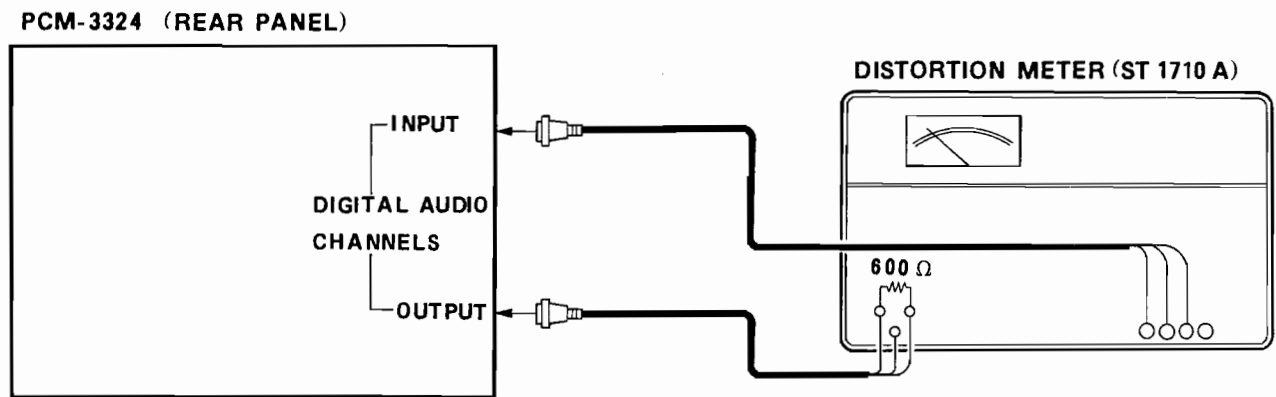
The level should drop suddenly above 20 kHz.

Note: When the frequency of the oscillator becomes 20 kHz or more, a sudden level drop occurs. Because of this, when frequencies around 20 kHz are set on the oscillator, they should be set accurately using a frequency counter.



6-6-8. Distortion Rate Measurement (1)

1. Connection



2. Operation Process

- 1) TURN OFF the EMPHASIS SW on the TSW pannel.
- 2) Connect the oscillator and the distortion meter to ANALOG IN and ANALOG OUT respectively. Change the oscillator level and frequency as follows, and measure the distortion rate in each case.
 1. Frequencies: 400 Hz, 1 kHz, 10 kHz
 2. Levels: -16 dB, -6 dB, +4 dB, +19 dB and +23.5 dB for each frequency
- 3) Measure CH2 to CH24 in the same way.

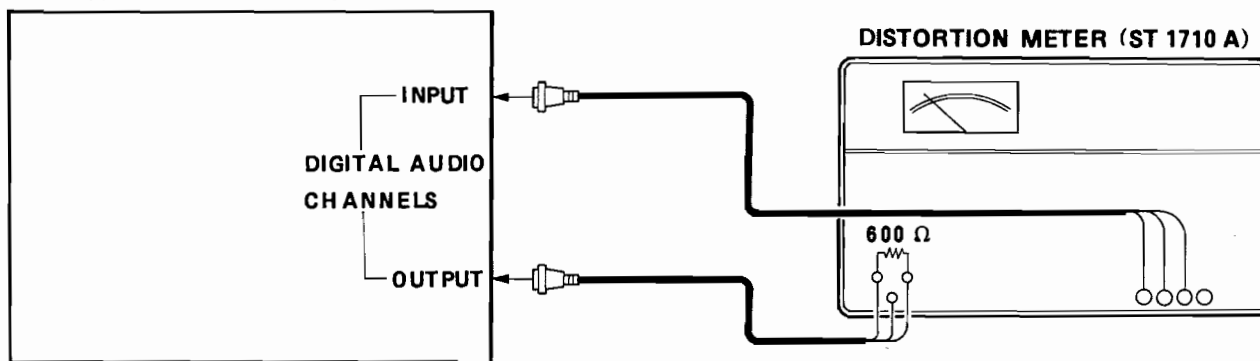
Specification

When +4 dB is input, it should be less than 0.05%.

6-6-9. Distortion Rate Measurement (2)

1. Connection

PCM-3324 (REAR PANEL)



2. Operation Process

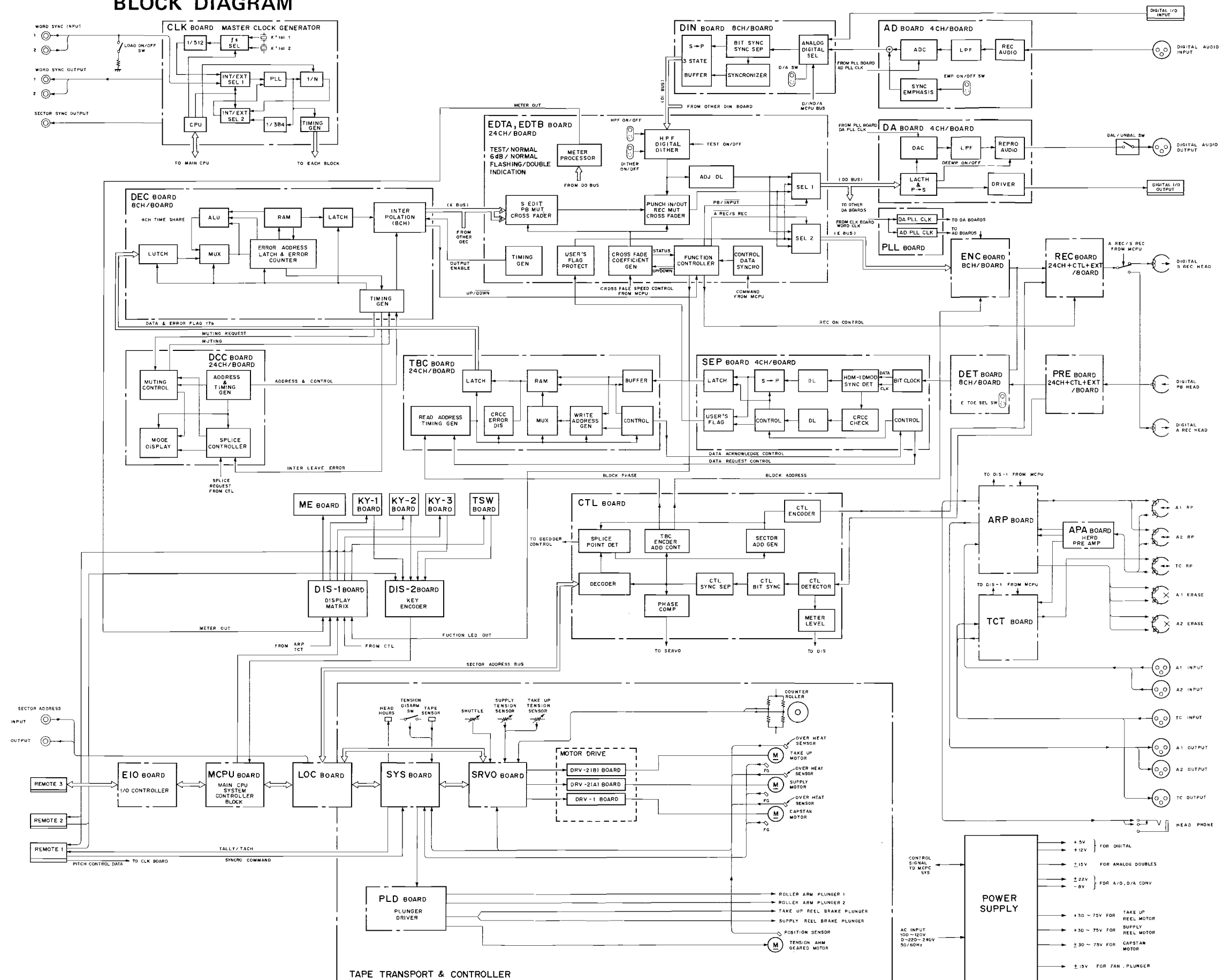
- 1) TURN ON the EMPHASIS SW on the TSW PANNEL.
- 2) Connect the oscillator and the distortion meter to ANALOG IN and ANALOG OUT respectively. Change the oscillator level and frequency as follows, and measure the distortion rate in each case.
 1. Frequencies: 400 Hz, 1 kHz
 2. Levels: +4 dB, +19 dB and +23 dB for each frequency
- 3) Measure CH2 to CH24 in the same way.

Specification

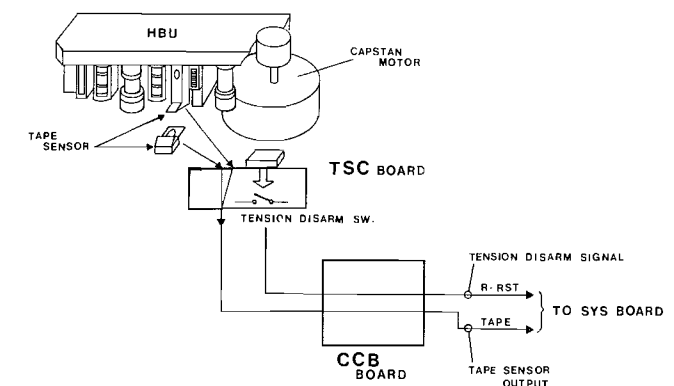
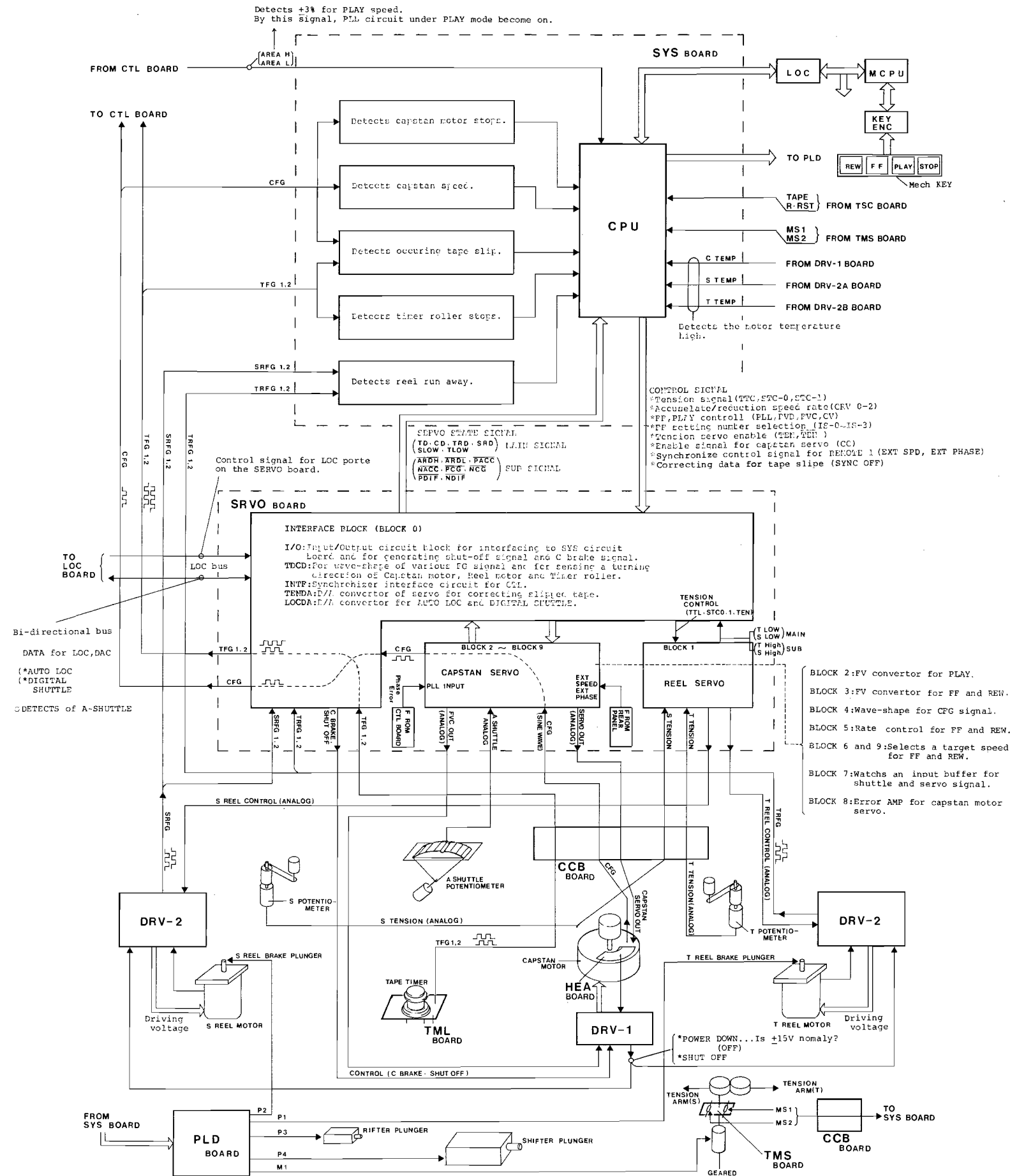
Should be less than 0.05% in all cases.

SECTION 7 BLOCK DIAGRAM

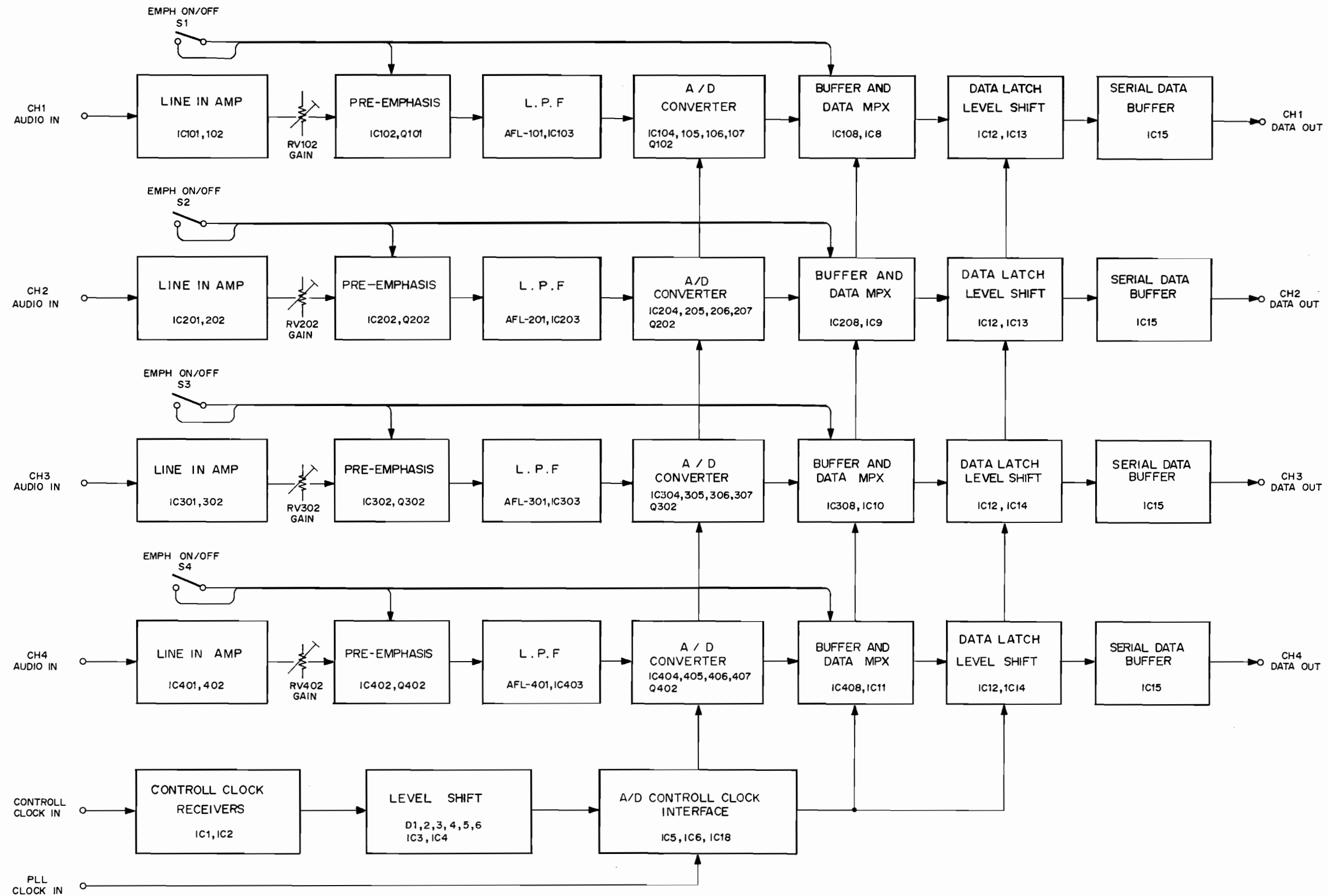
OVERALL (1) SIGNAL FLOW



OVERALL (2)
SERVO SYSTEM



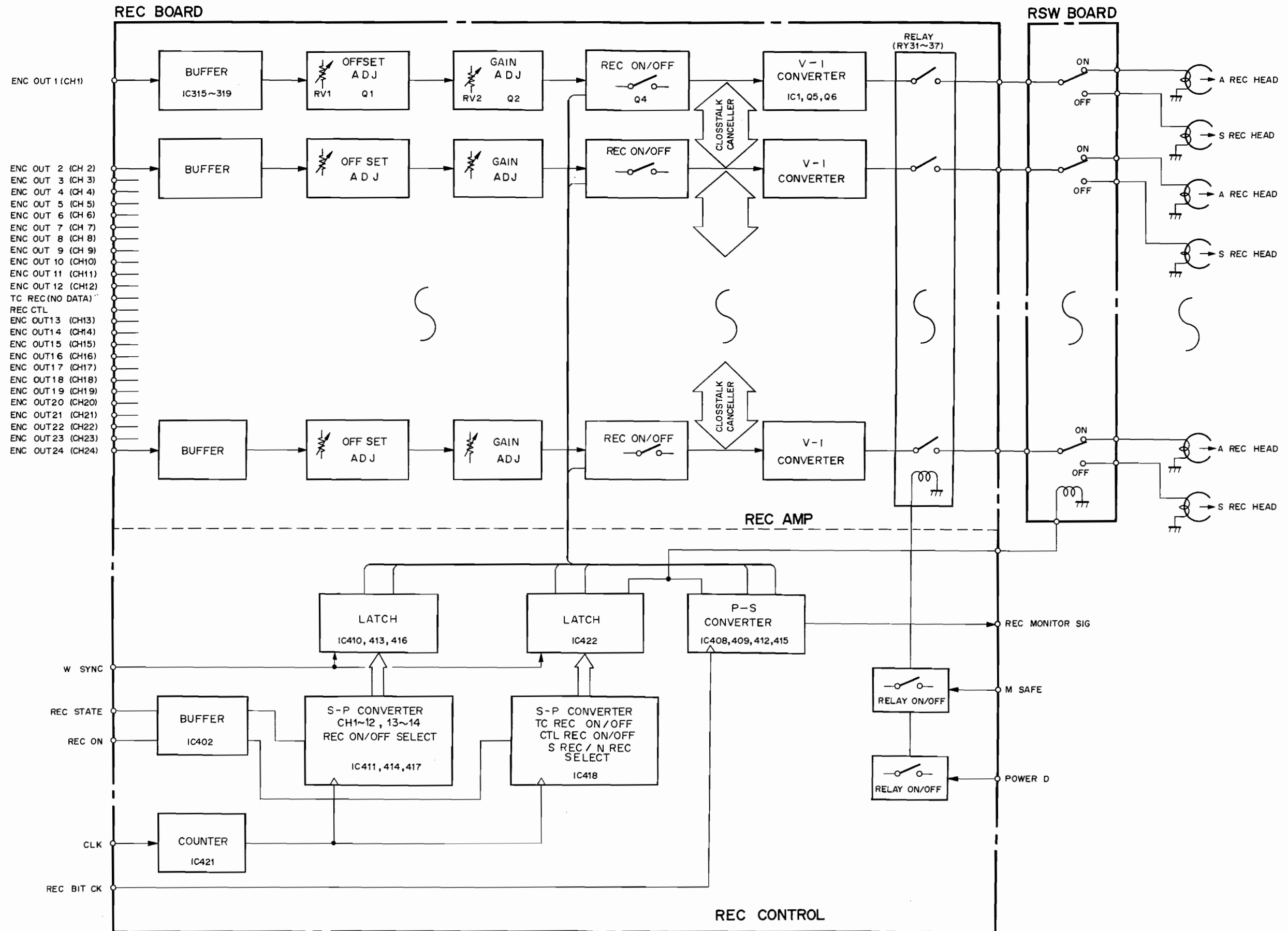
AD BOARD



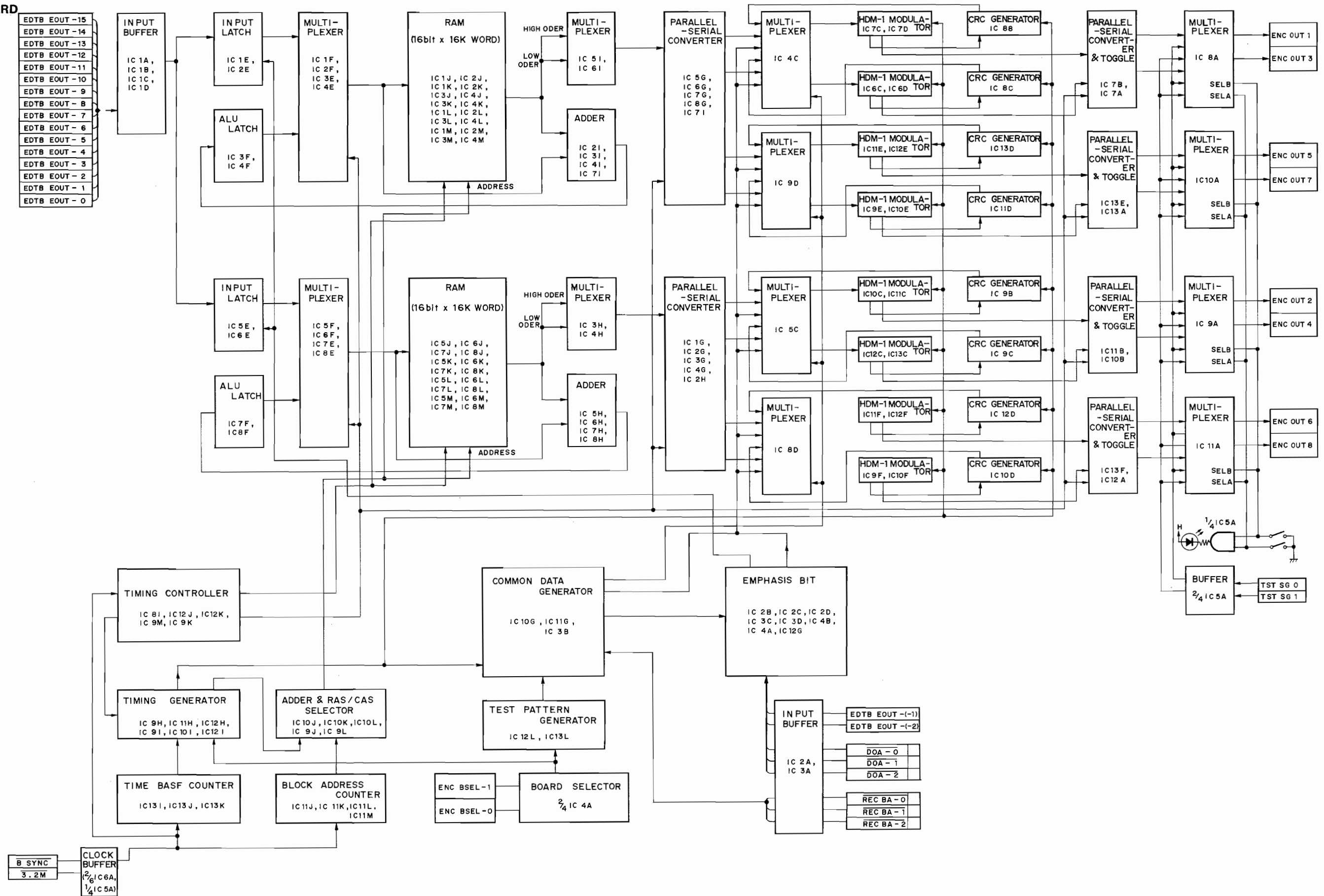
DA BOARD



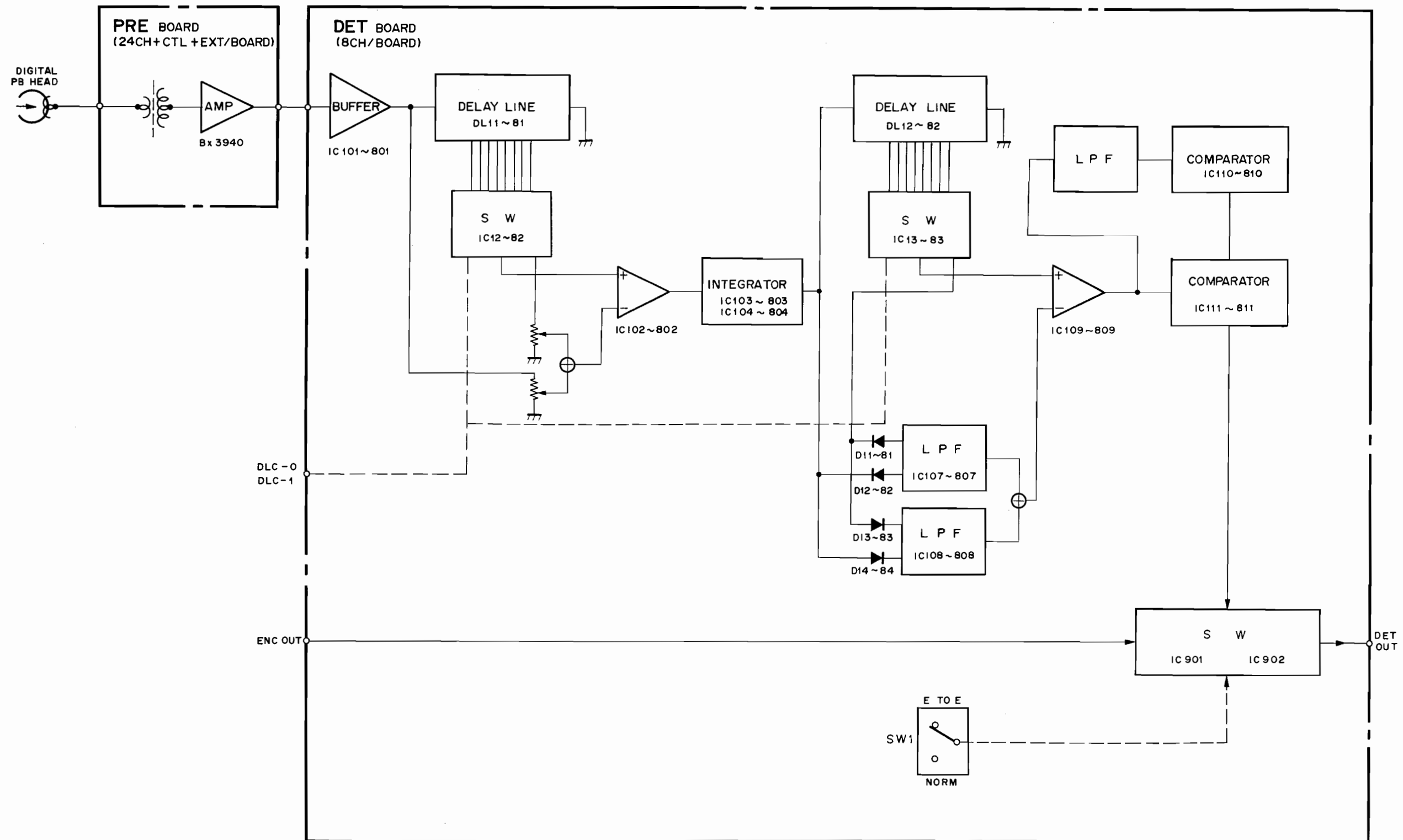
REC BOARD



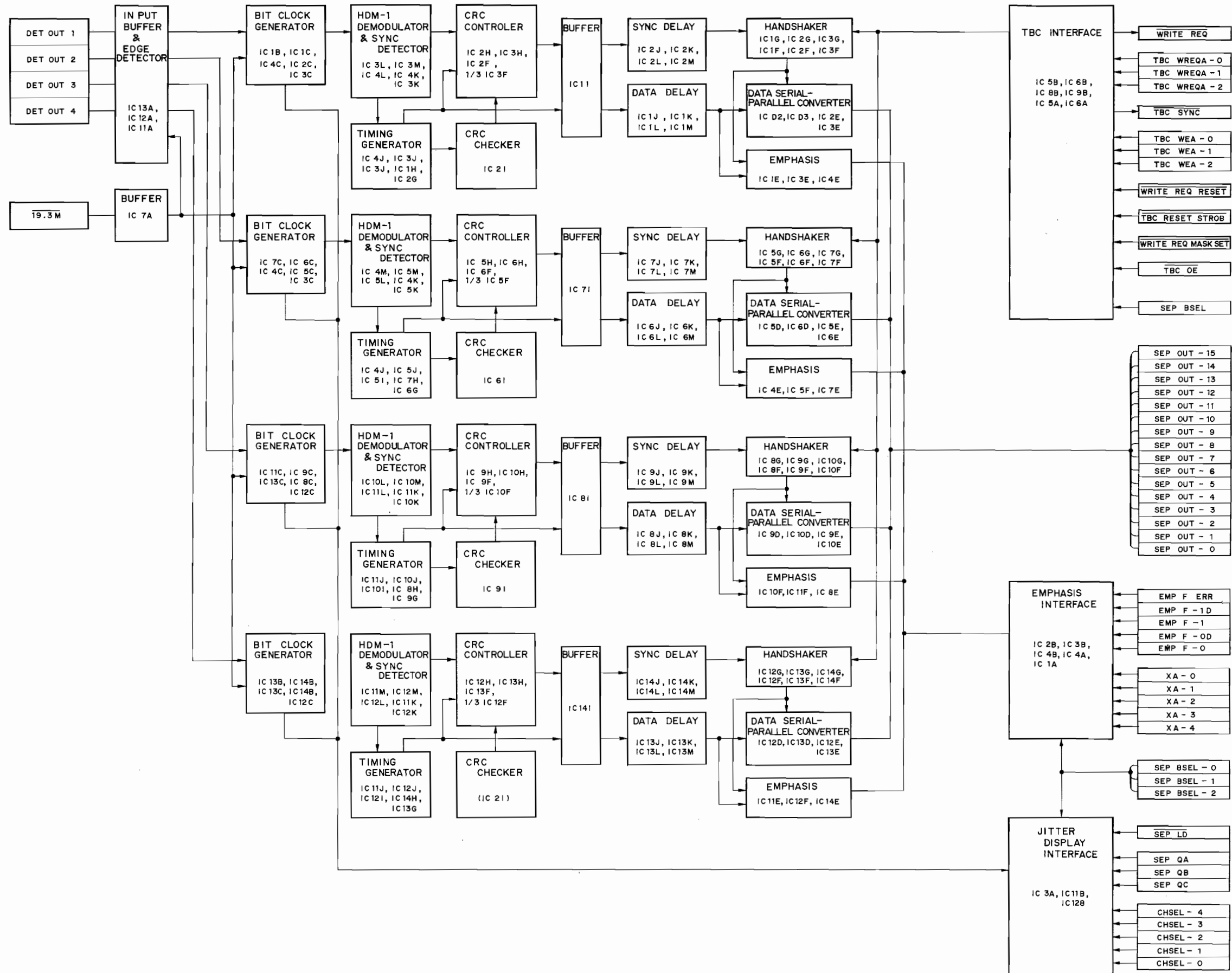
ENC BOARD



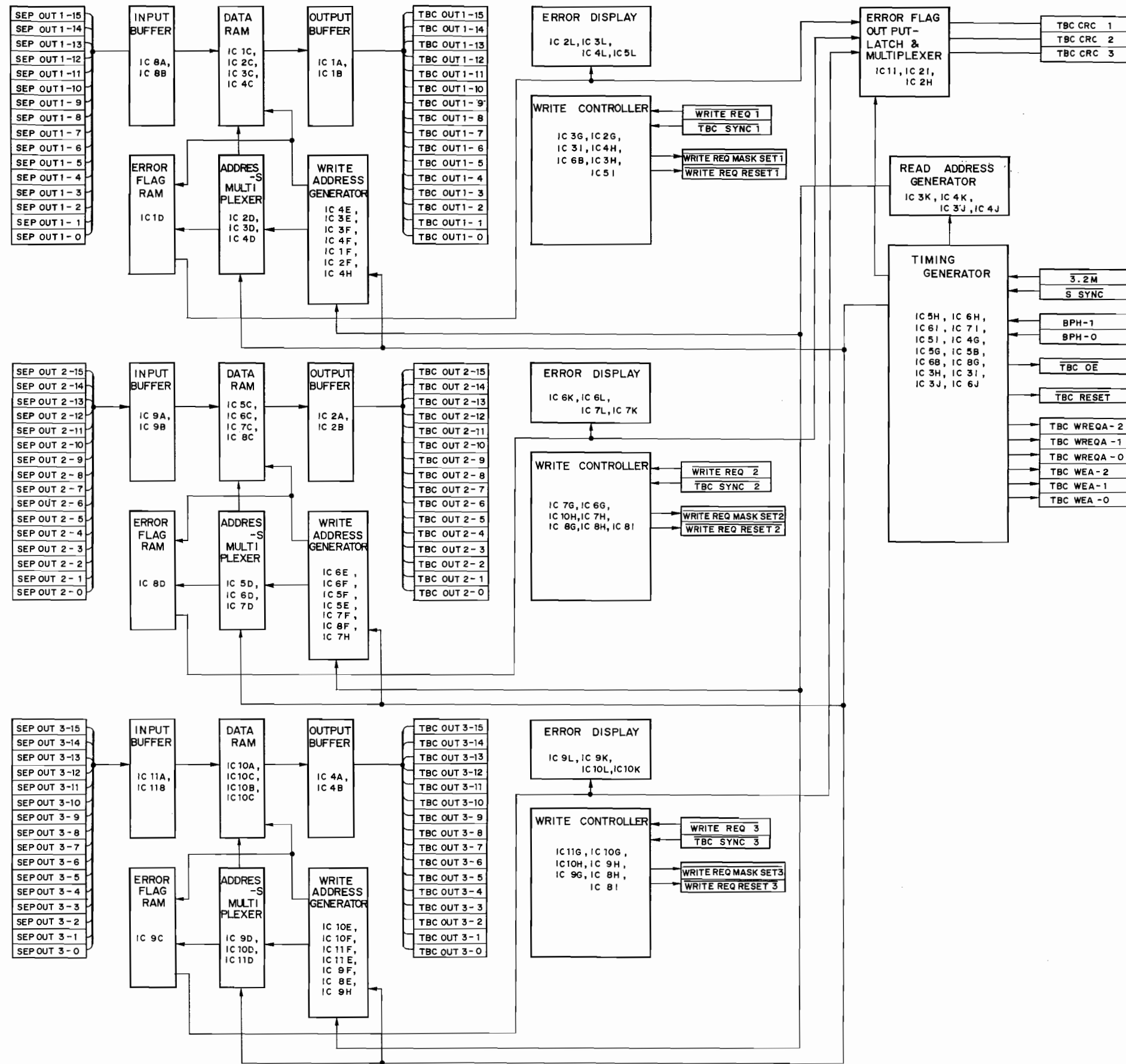
DATA TRACK SECTION (PRE, DET BOARD)



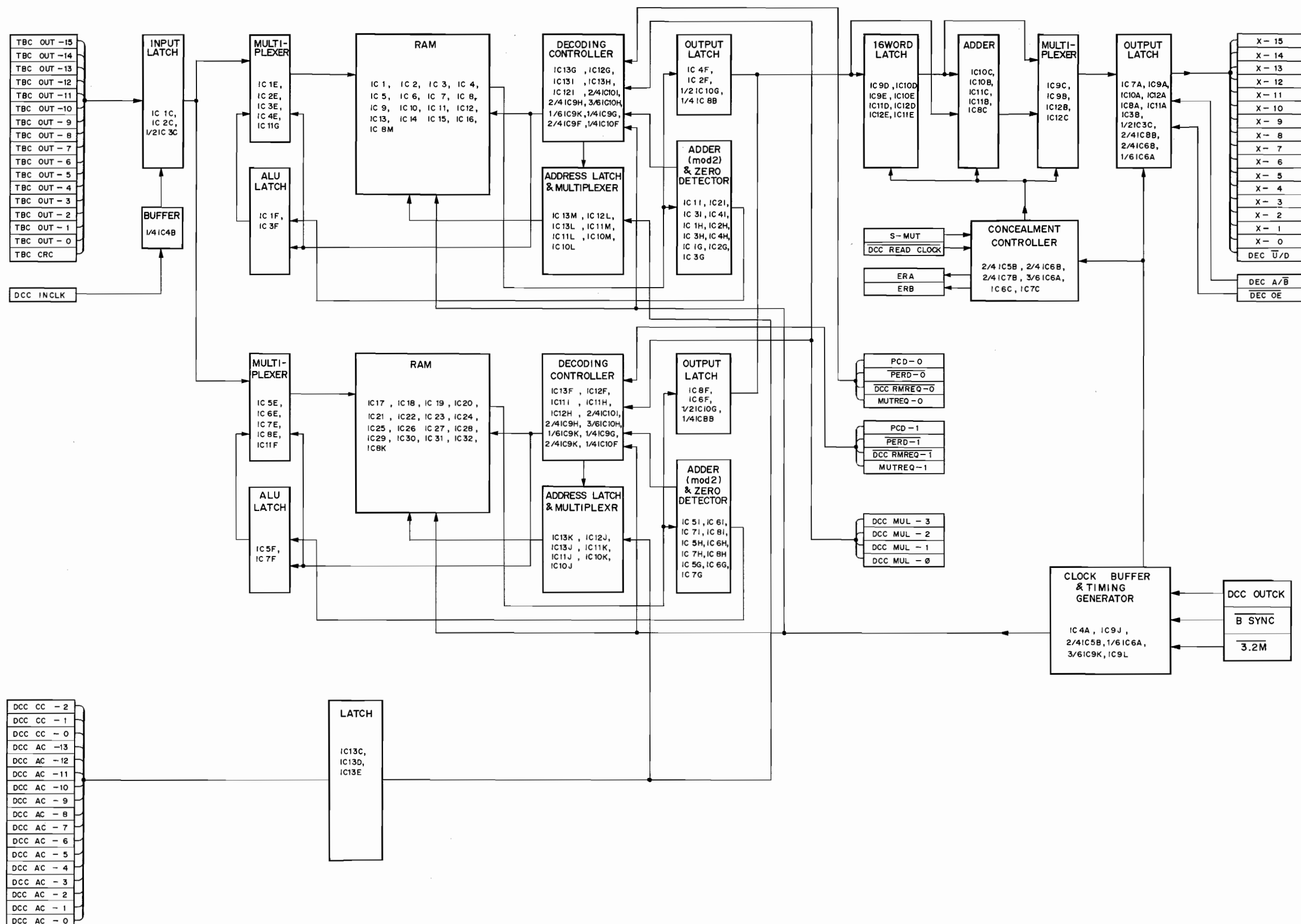
SEP BOARD



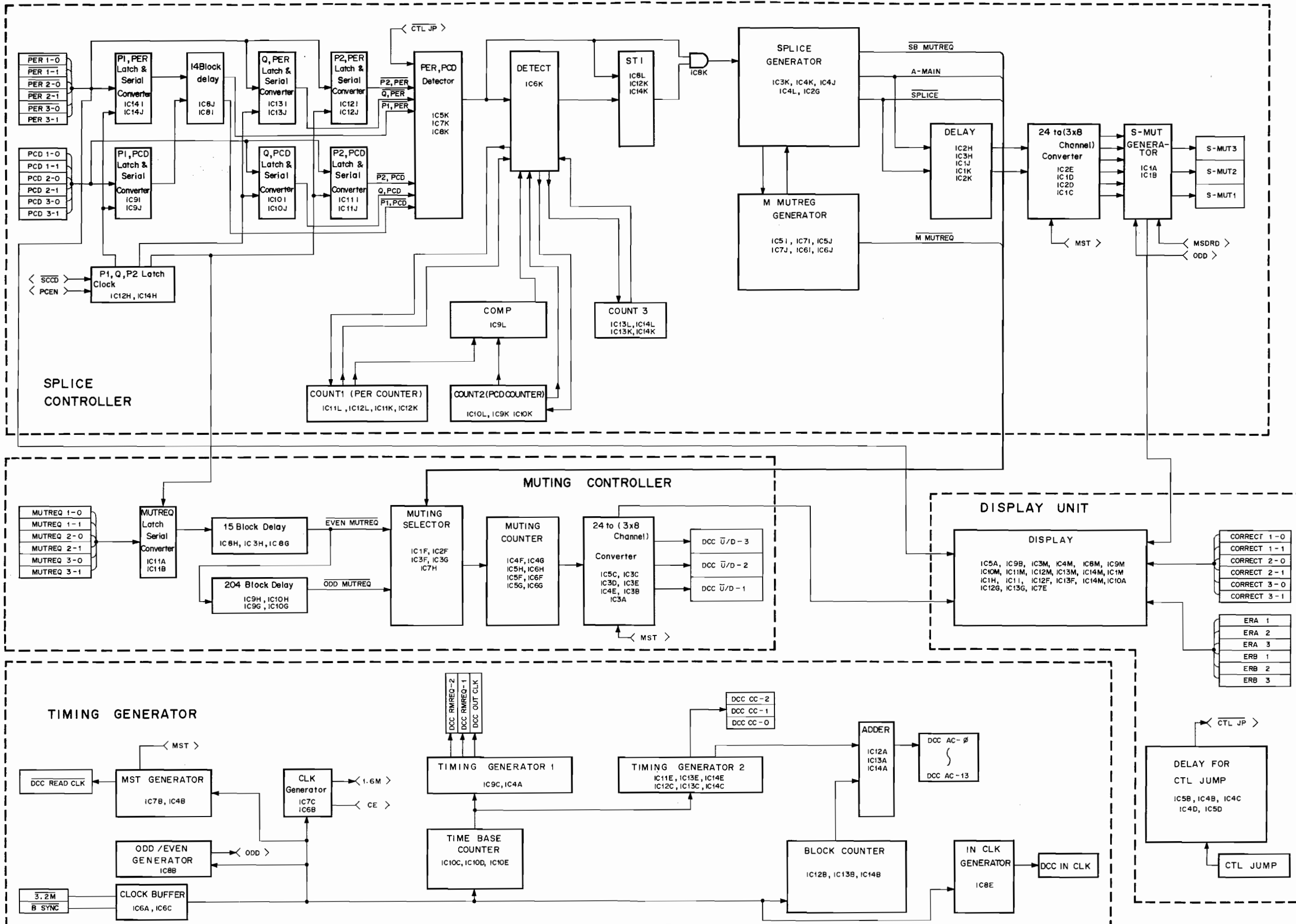
TBC BOARD



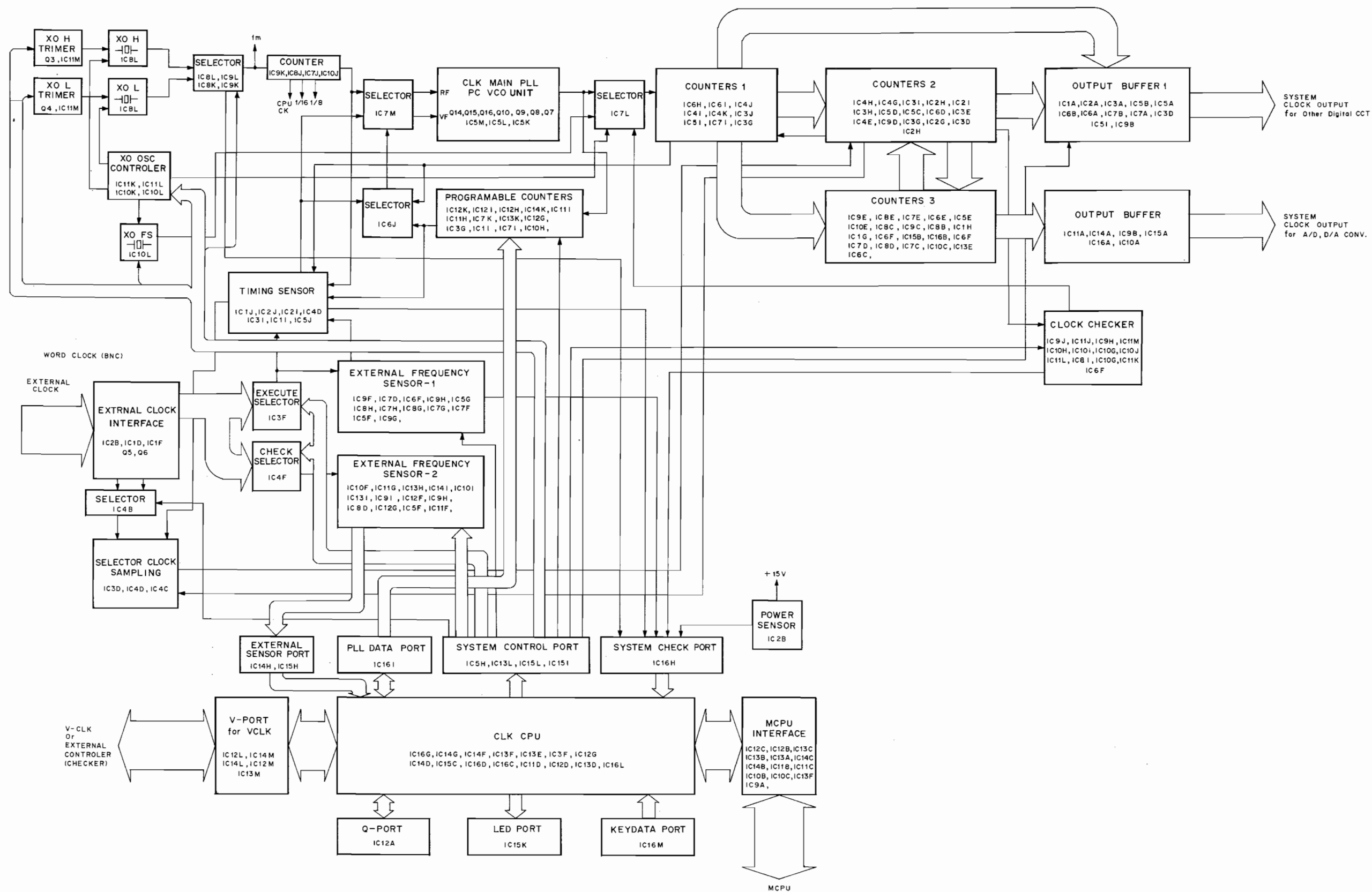
DEC BOARD



DCC BOARD



CLK BOARD



SWITCHES ON THE CLK BOARD

1. The Bit Switch is Preset as shown below.

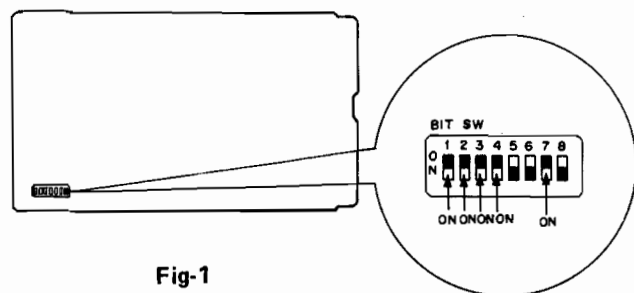
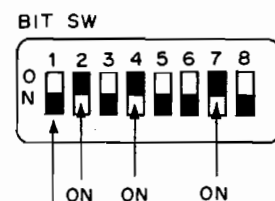


Fig-1

Set the Bit switch as follows according to the system employed.

(1) PCM-3324 + RM-3310

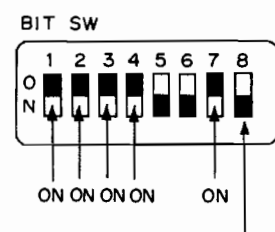
- REMOTE-1 cannot be used. But it is of no problem if connected to external equipment.



- When inputting WORD CLOCK through the BNC connector of the PCM-3324, set the bit 1 to ON.

(2) Only the PCM-3324

- REMOTE-1 can be used.



- When SECTOR SYNC is not necessary, set the bit 8 to ON.

2. Functions of the Bit Switch

Bit 1, 5, 6: When the PCM-3324 is controlled by the RM-3310, external clock source is controlled according to a command from REMOTE-3. Bit 1 selects REMOTE-3 or the bit switch on the CLK to input external source code. When the bit switch 1 is ON, switching of input WORD CLOCK to CLK is determined by combination of the bit 5 and 6 as shown in Fig. 2, and when the bit 1 is OFF, it is determined by a command from REMOTE-3.

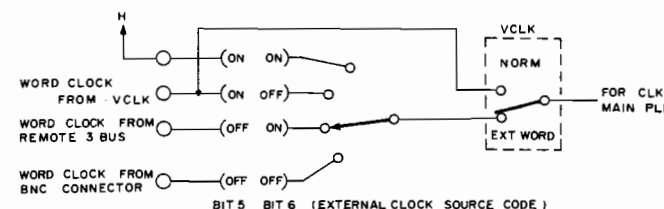
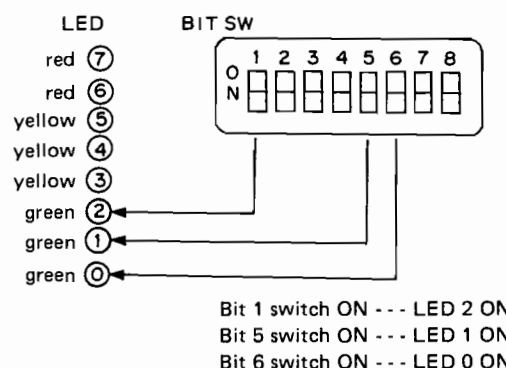


Fig. 2 External Clock Source Selector

Note: When the VCLK board is installed in the PCM-3324 and the VCLK board selects VSYNC, external clock input is controlled by WORD CLOCK output from the VCLK board.



- Bit 2: Should be always set to ON (normal operation mode). OFF position is used when servicing and emergency.
- Bit 3: Selects REMOTE-1 or REMOTE-3 (RM-3310) to control the CLK CIRCUIT. Set the bit 5 to ON to select REMOTE-1. Set the bit 5 to OFF to select REMOTE-3. In this case, LED 4 on the CLK board lights up.
- Bit 4: Should be always set to ON.
- Bit 7: Should be always set to ON.
- Bit 8: Enables or disables external SECTOR SYNC. Set the bit 0 to OFF to enable (normal operation mode). Set the bit 0 to ON to disable.

3. LED Display on the CLK Board

There are eight LED displays on the CLK board as follows:

LED display:

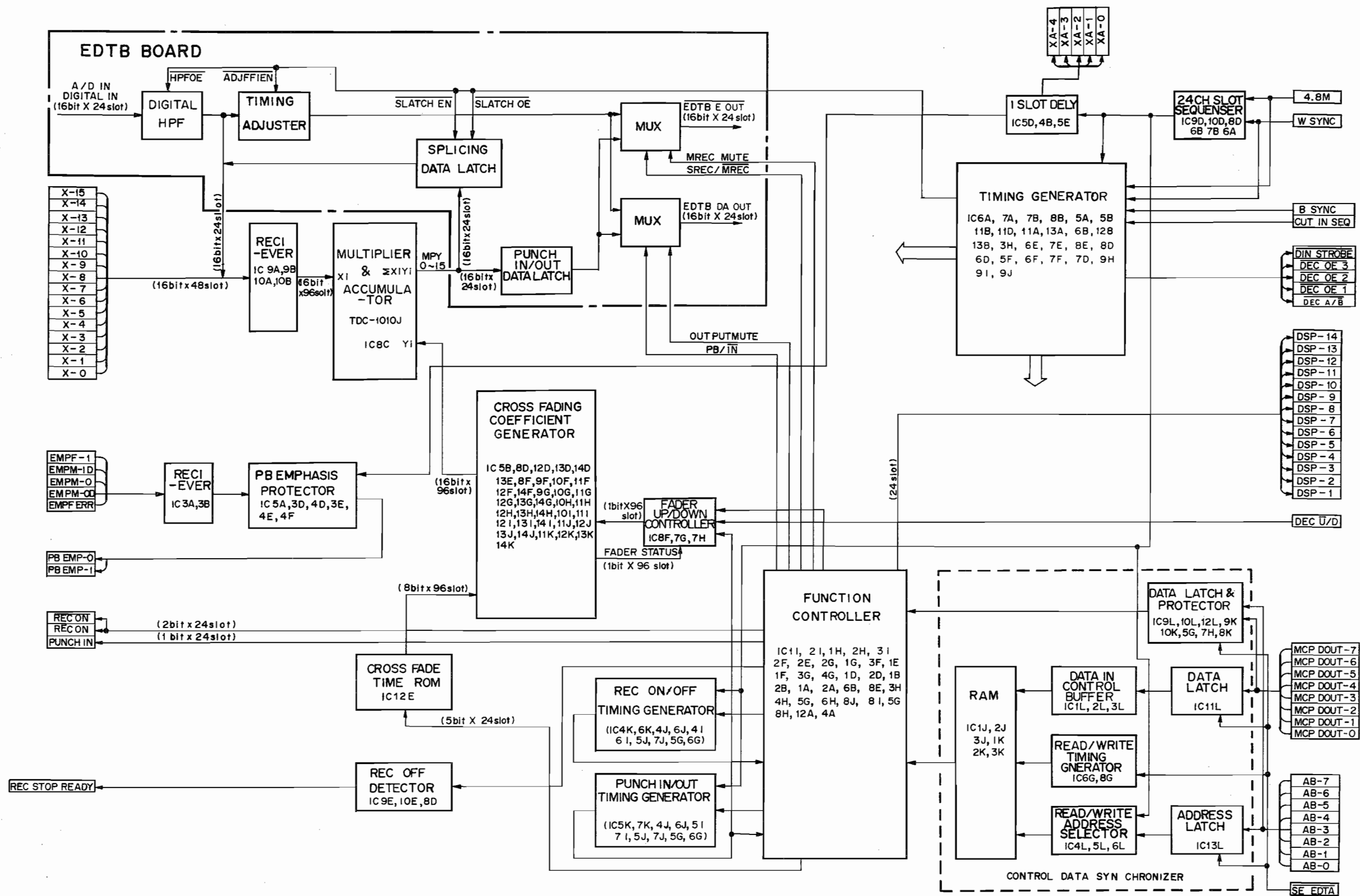
LED #	Color
7	red
6	red
5	yellow
4	yellow
3	yellow
2	green
1	green
0	green

- The LED displays can be seen when the CLK board is drawn out using a service use extension board.

- LED 7: MCK AB MASTER CLOCK ABNORMAL
Lights up when something is wrong with the MASTER CLOCK. (Failure is detected by the self-diagnosis program.)
- LED 6: MODE B
Lights up when the CLK board is in MODE B.
Set the bit 2 to OFF when you want to use the CLK board which has been in a MCK AB condition.
[CLK board function under 44.1 kHz.]
- LED 5: EXT AB EXTERNAL CLOCK ABNORMAL
Lights up when WORD CLOCK has not sent or when the sampling frequency of WORD CLOCK is incorrect.
- LED 4: REM 3
Lights up when the bit 3 is OFF, indicating that the PCM-3324 can be controlled by the RM-3310. In this case, REMOTE-1 cannot be used.
- LED 3: SECTOR SYNC ENABLE
Lights up when SECTOR SYNC functions.
- LED 2: EXTERNAL CLOCK SELECT
Lights up when the CLK selects external clock. The bit 5 and 6 function.
- LED 1, 0: EXTERNAL CLOCK SOURCE CODE
Indicate contents of WORD CLOCK input.

Input	LED 1	LED 0
BNC Connector Input	OFF	OFF
REMOTE 3 Input	OFF	ON
VCLK Input	ON	OFF
No External Input	ON	ON

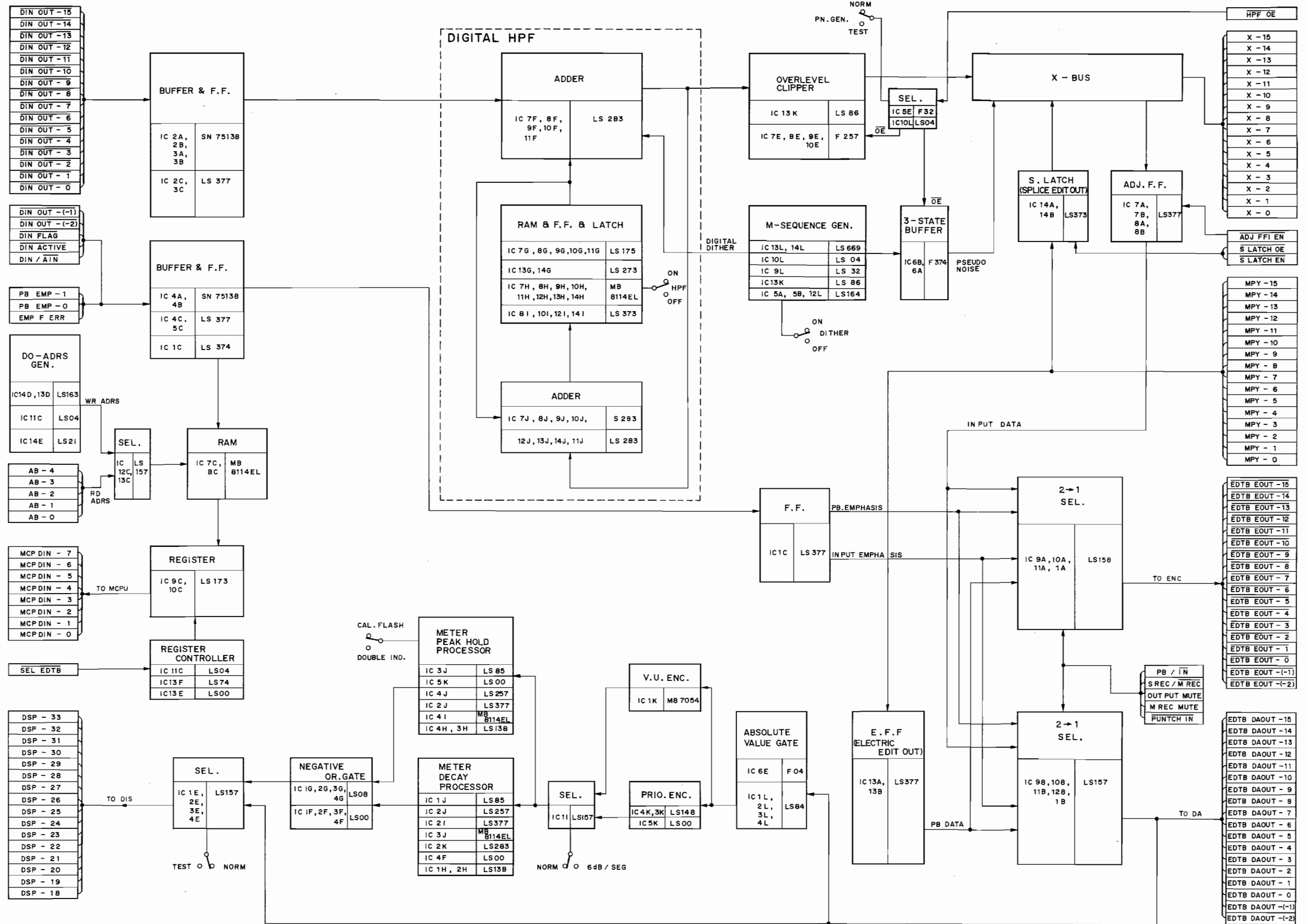
EDT A BOARD





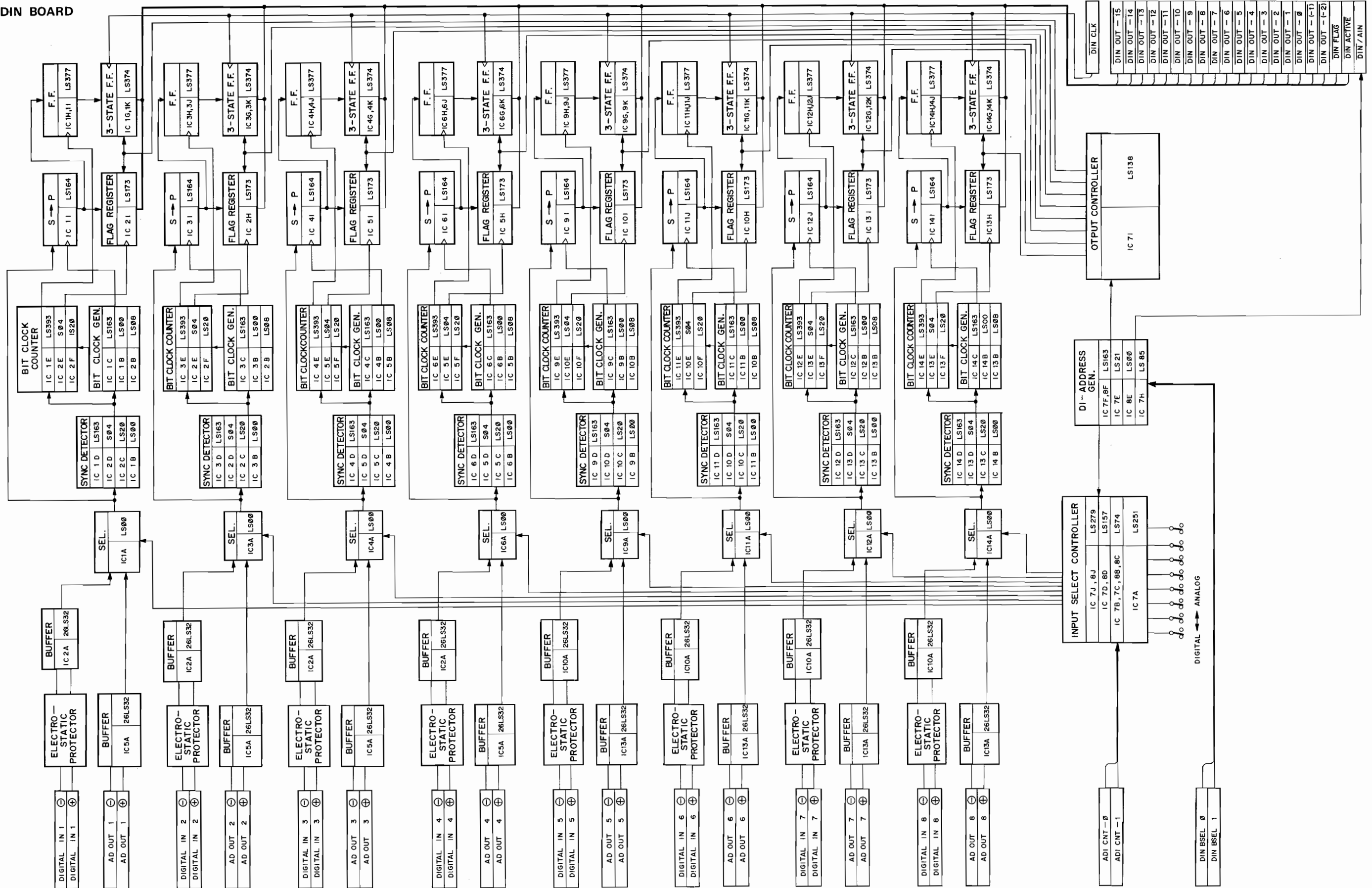
EDT B EDT B

EDT B BOARD

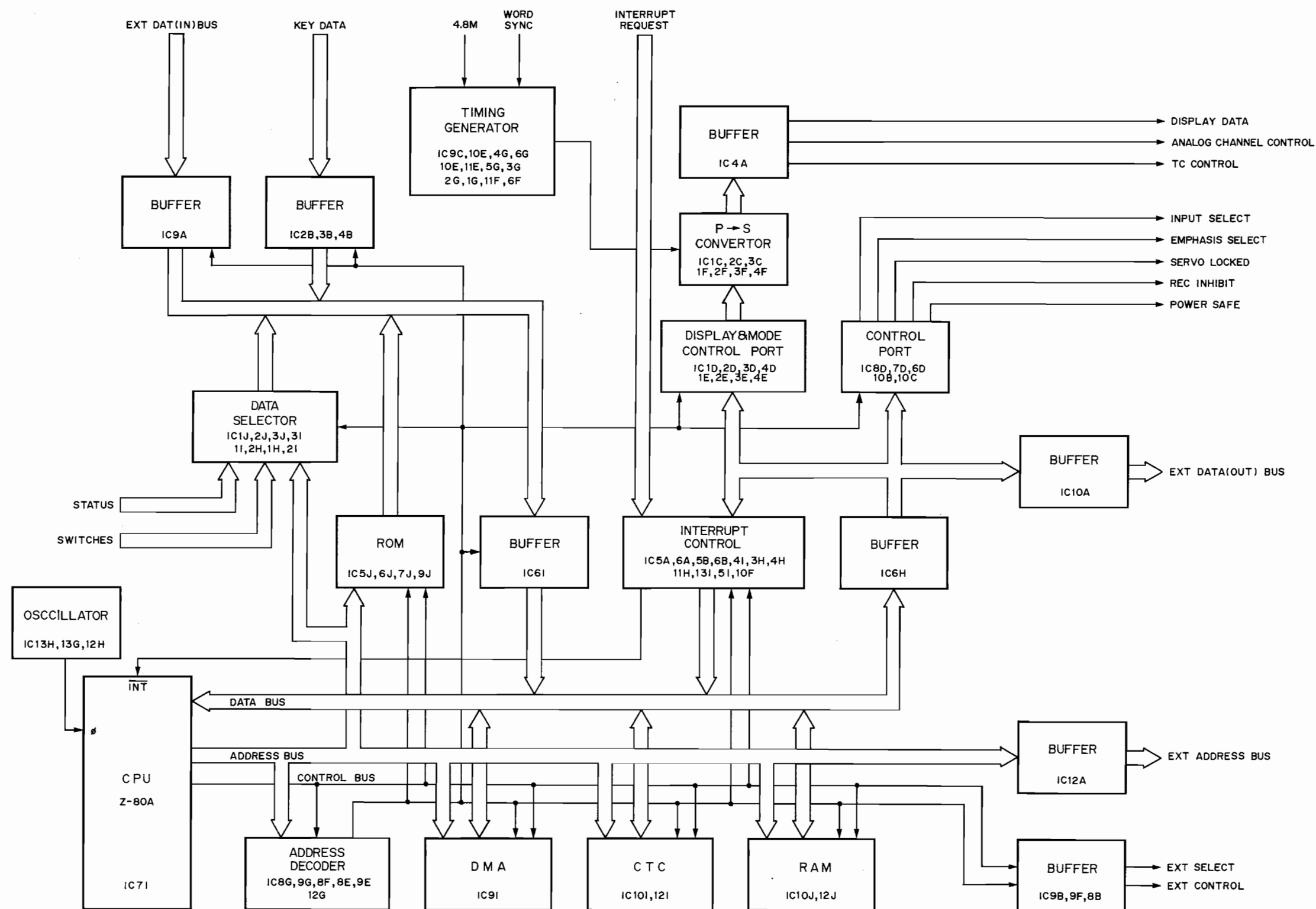


DIN BOARD

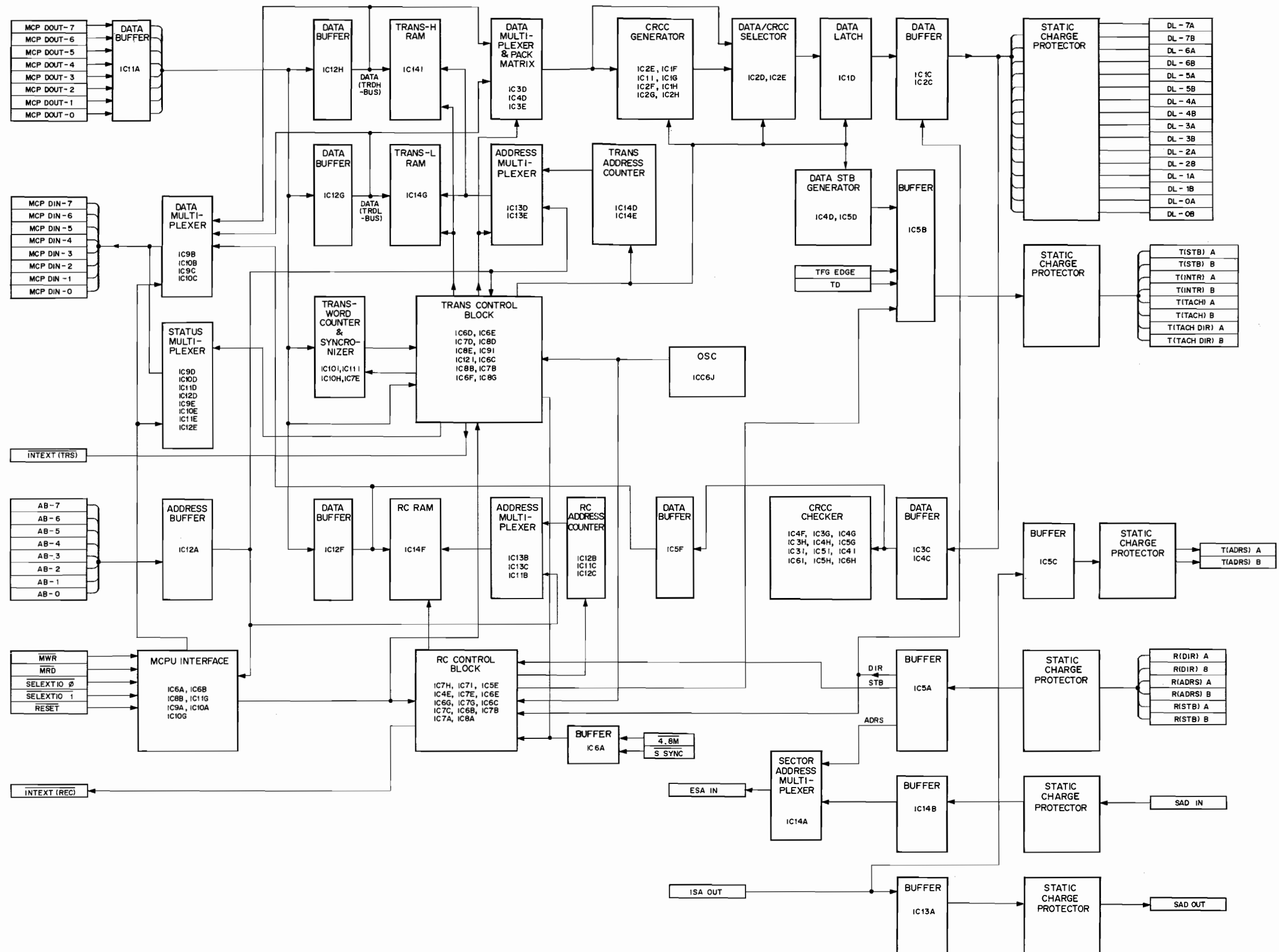
DIN DIN



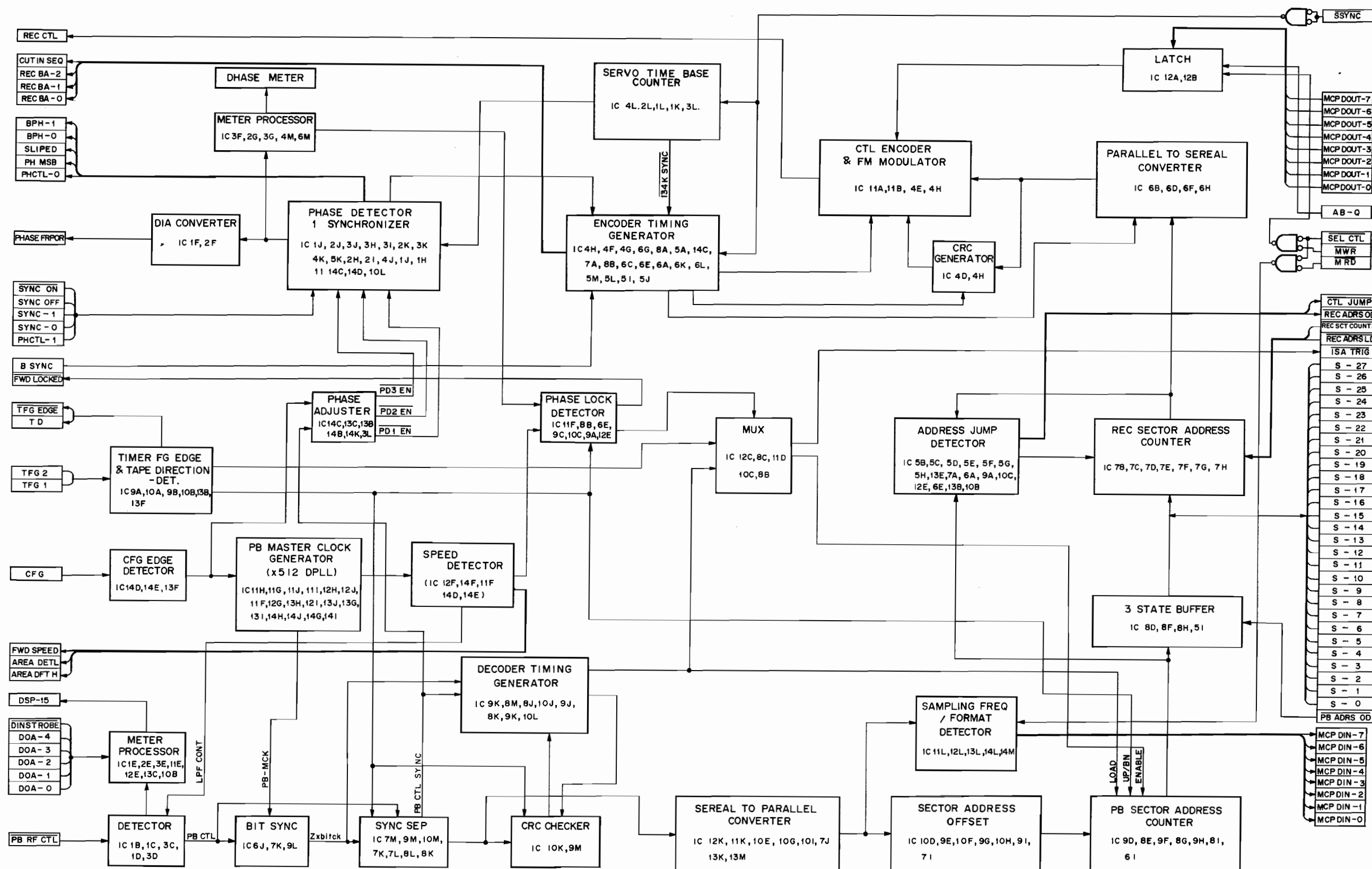
MCPU BOARD



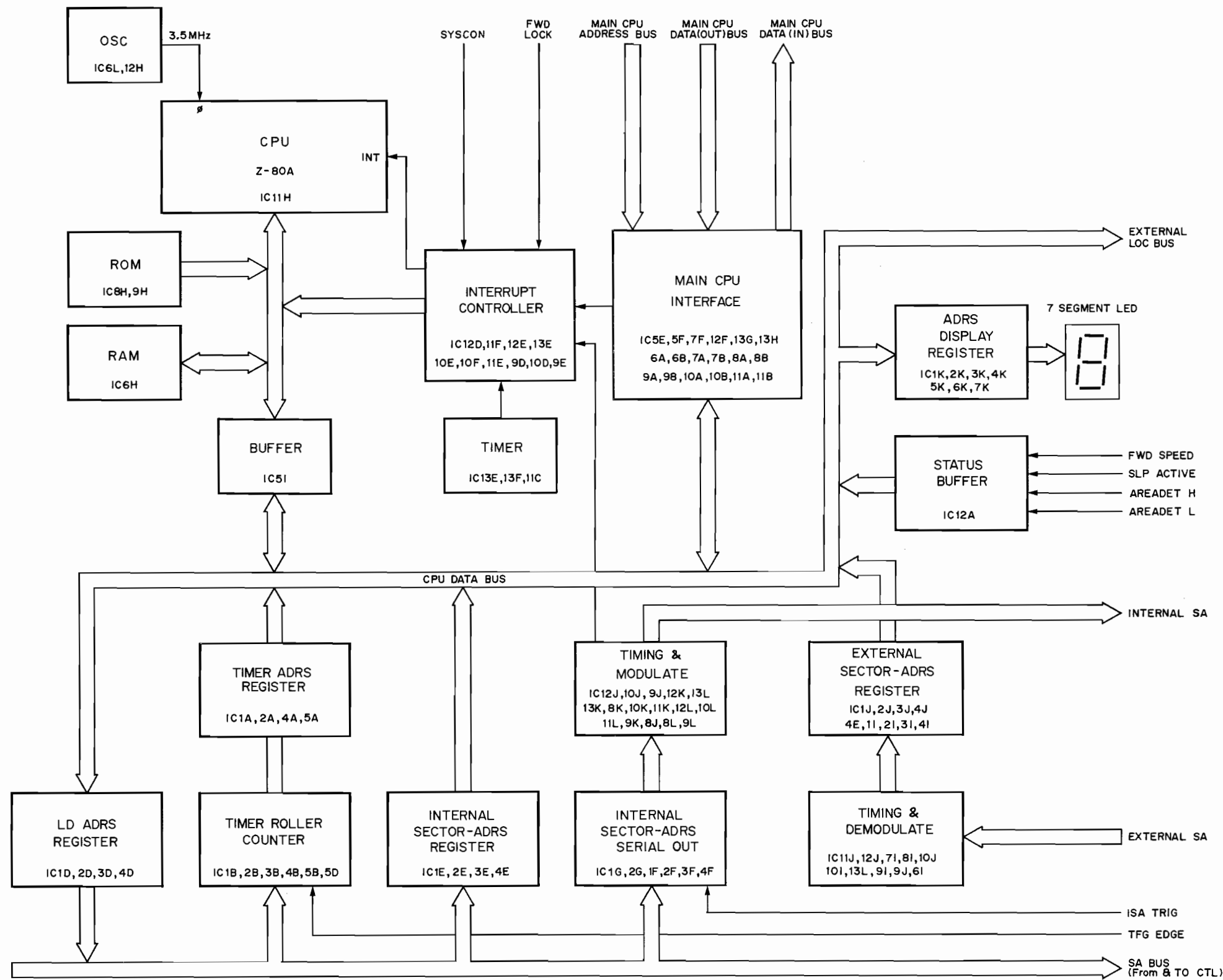
EIO BOARD



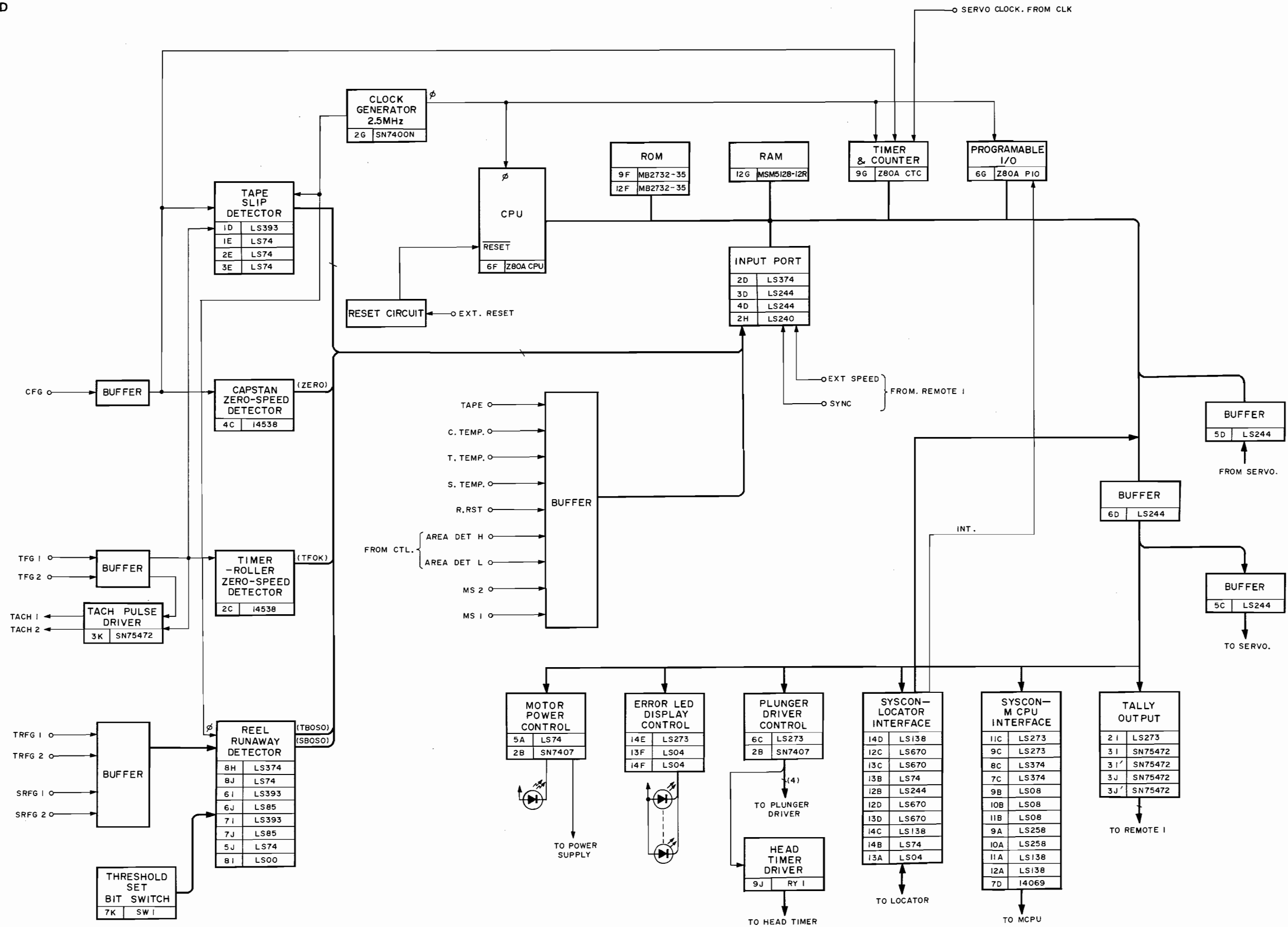
CTL BOARD



LOC BOARD

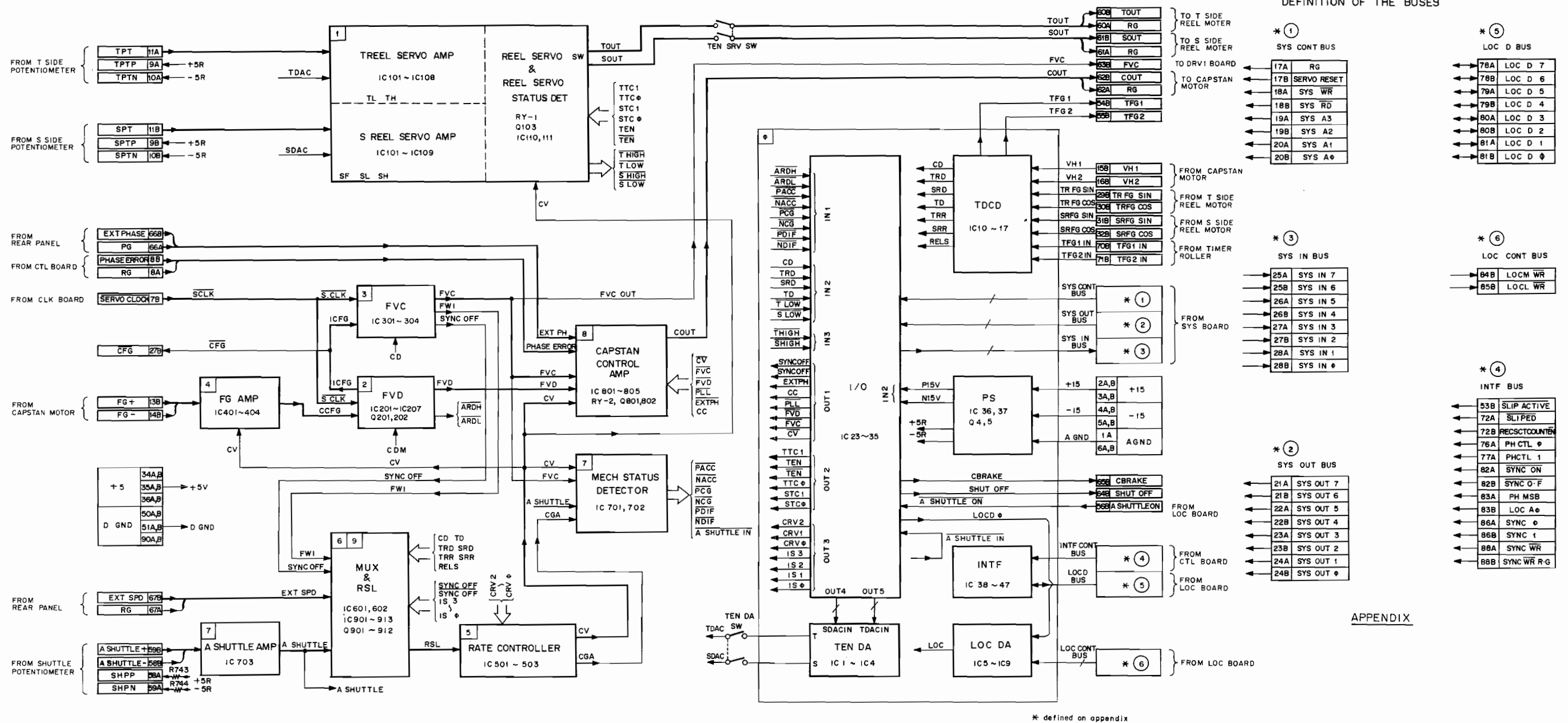


SYSCON BOARD

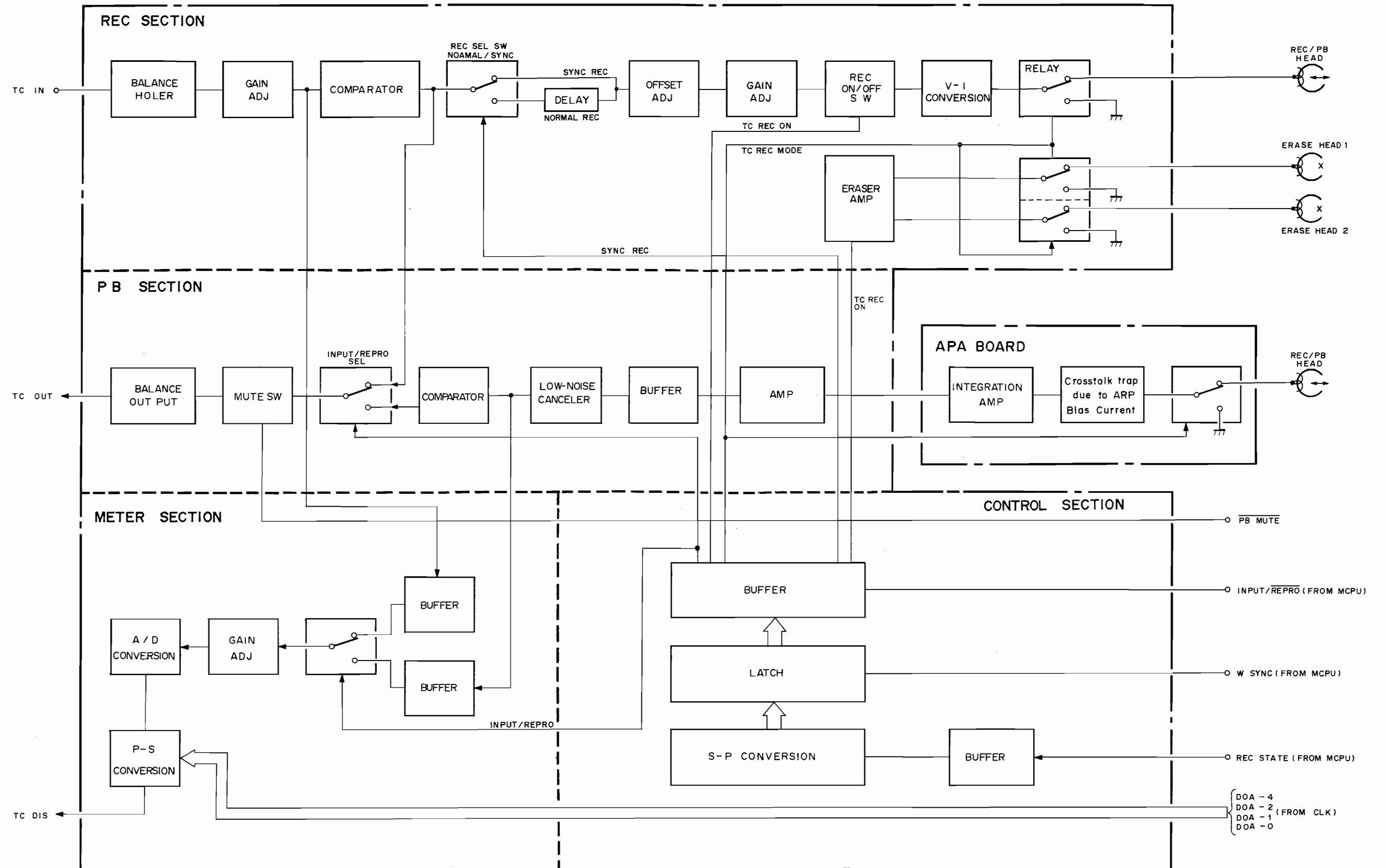


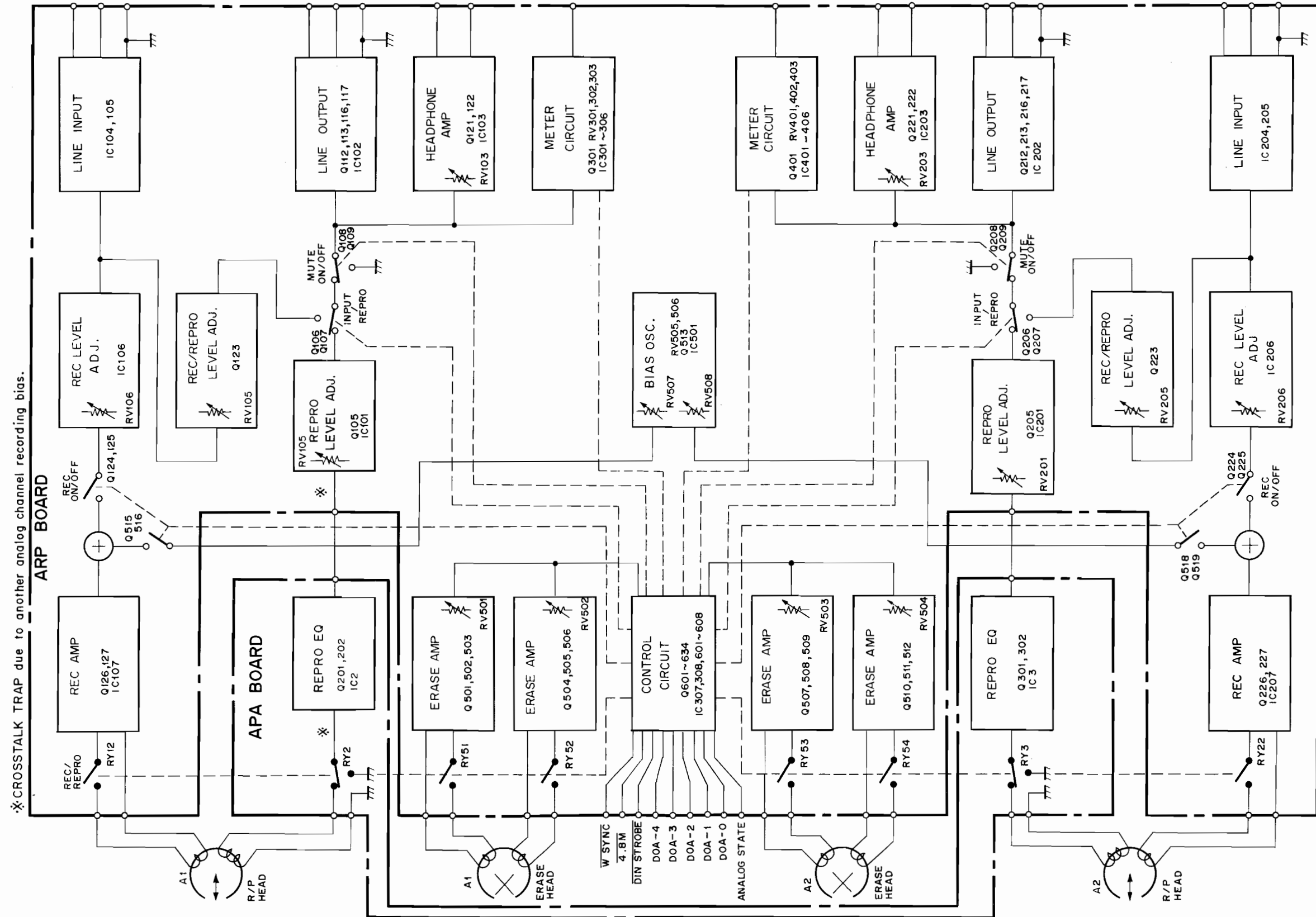
SRVO	SRVO
------	------

SRVO BOARD

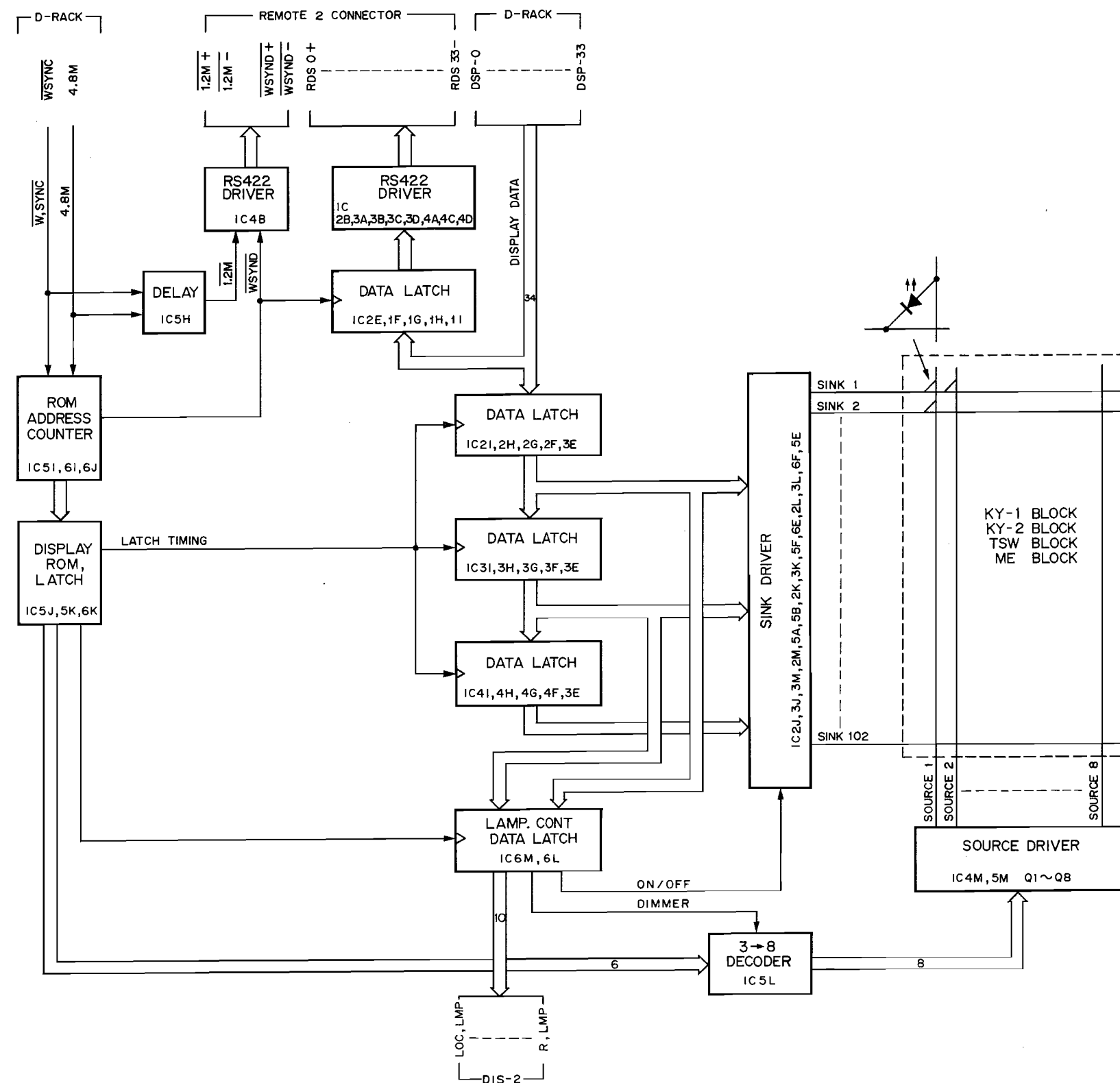


TCT BOARD

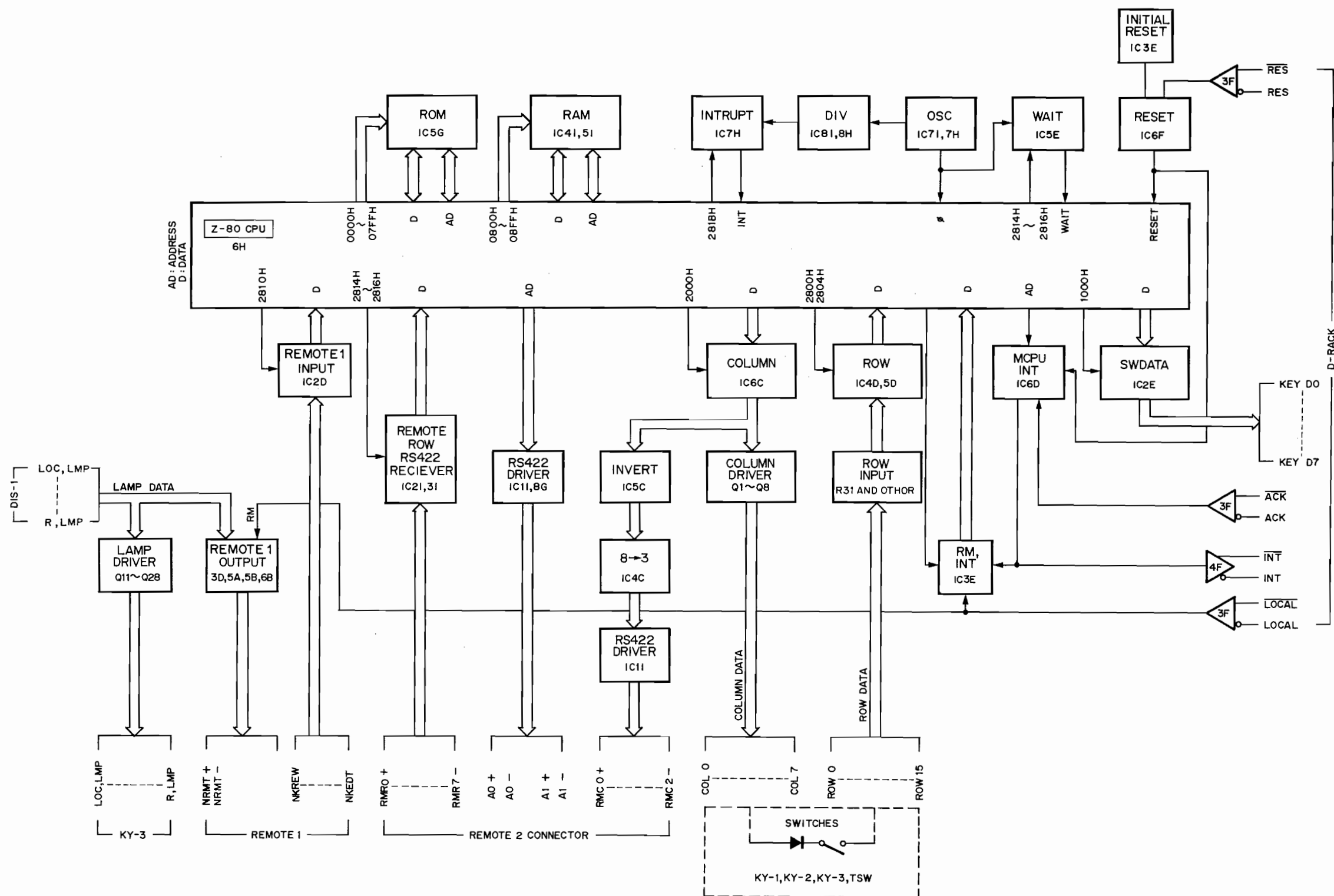




DIS-1 BOARD (DISPLAY)



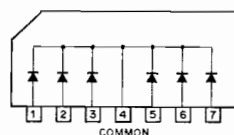
DIS-2 BOARD (KEY)



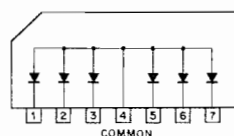
SECTION 8

SEMICONDUCTOR ELECTRODES

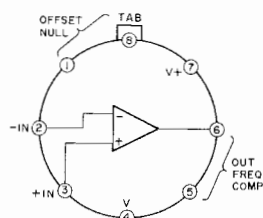
μPA54H
DIODE ARRAY
— SIDE VIEW —



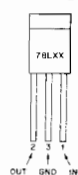
μPA64H
DIODE ARRAY
— SIDE VIEW —



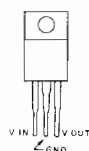
μA725HC
OPERATIONAL AMPLIFIERS
— TOP VIEW —



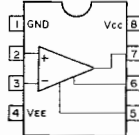
μPC78L08
3-TERMINAL POSITIVE VOLTAGE
REGULATORS
— TOP VIEW —



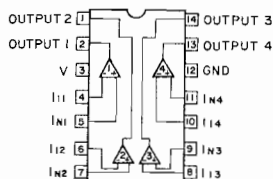
μPC78M05H
μPC78M10H
μPC78M12H
μPC78M18H
μPC7808H
μPC7812H
μPC7815H
3-TERMINAL POSITIVE VOLTAGE
REGULATORS
— TOP VIEW —



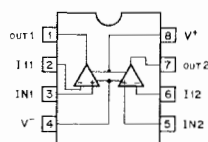
μPC311C
VOLTAGE COMPARATOR
— TOP VIEW —



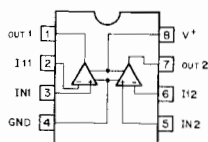
μPC339C



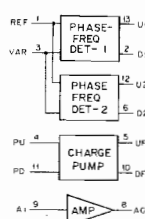
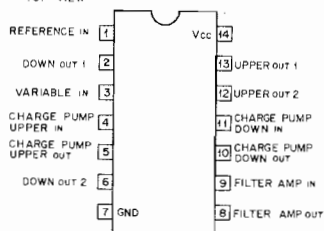
μPC358C
OPERATIONAL AMPLIFIER
— TOP VIEW —



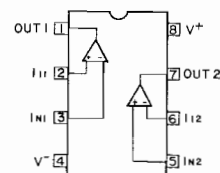
μPC393C
2-CHANNEL COMPALATOR
— TOP VIEW —



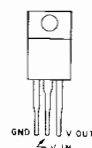
μPC1008C
MC4044P
PHASE/FREQ. DETECTOR
— TOP VIEW —



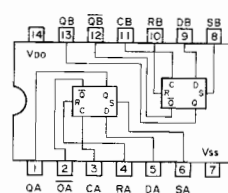
μPC4558C



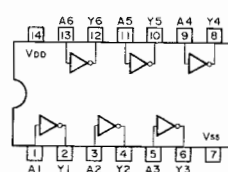
μPC7905H
μPC7908H
μPC7912H
μPC7915H
μPC7918H
3-TERMINAL NEGATIVE
VOLTAGE REGULATORS
— TOP VIEW —



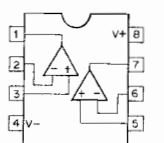
μPD40138C
DUAL D-TYPE FLIP-FLOP
— TOP VIEW —



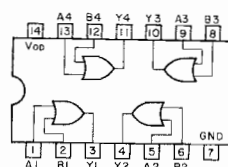
μPD4069UBC
HEX. INVERTER
— TOP VIEW —



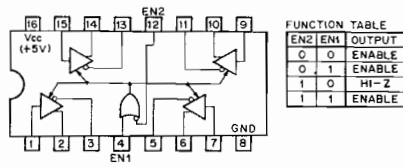
μPC4557C
OPERATIONAL AMPLIFIER
(WIDE BAND, LOW NOISE)
— TOP VIEW —



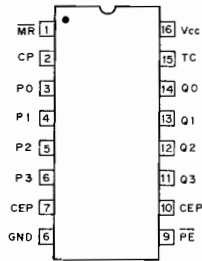
μPD4071C
QUAD 2-INPUT OR GATE
— TOP VIEW —



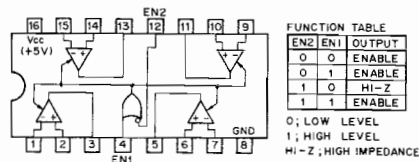
AM26LS31PC (ADVANCED MICRO DEVICE)
HIGH SPEED DIFFERENTIAL LINE DRIVER
— TOP VIEW —



AM74S161J
BCD DECADE/FOUR-BIT BINARY COUNTER
— TOP VIEW —

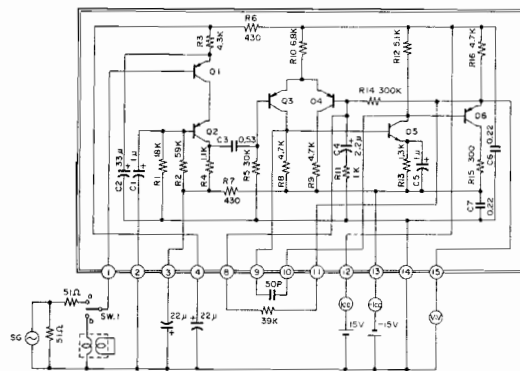
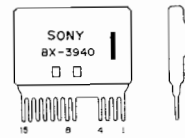


AM26LS32PC (ADVANCED MICRO DEVICE)
AM26LS33PC (ADVANCED MICRO DEVICE)
HIGH SPEED DIFFERENTIAL LINE RECEIVER
— TOP VIEW —

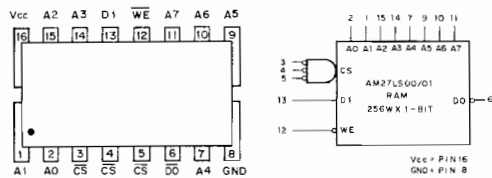


	SENSE	INPUT VOLT
LS32	±200mV	±7V
LS33	±500mV	±15V

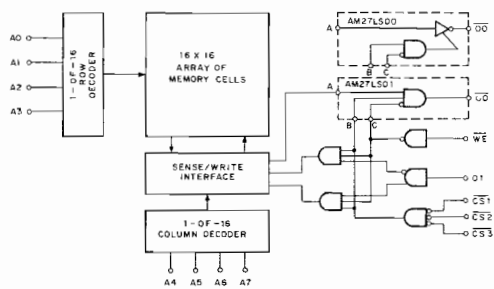
BX-3940
PRE AMPLIFIER



AM27LS00PC
LOW-POWER SCHOTTKY 256-BIT RANDOM MEMORIES
— TOP VIEW —

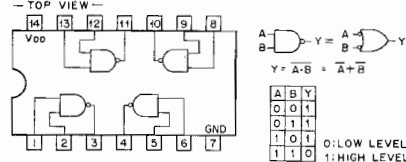


LOGIC DIAGRAM

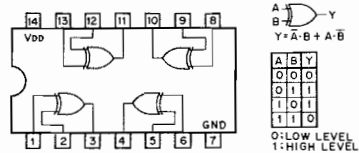


CD4011AE/BE
CD4011UB
MC14011BCP
MC14011UBCP
TC4011BF
TC4011BP
TC4011UBP
μPD4011BC
MSM4011RS
M884011B
HD14011BP

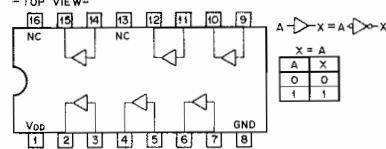
C-MOS 2-INPUT NANO GATE
— TOP VIEW —



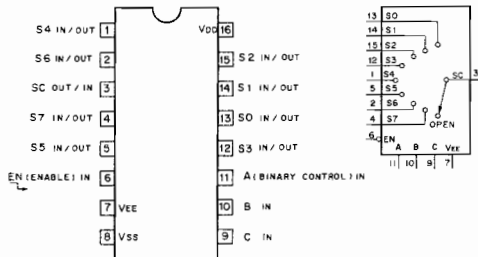
CD4030AE/BE
MC14030CP
TC4030BF
TC4030BP
μPD4030BC
μPD4030C
C-MOS EXCLUSIVE OR GATE
— TOP VIEW —



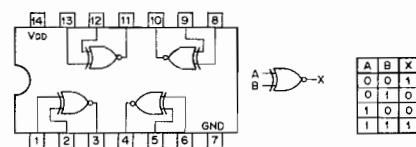
CD4050AE/BE
MC14050BCP
μPD4050C
TC4050BF
TC4050BP
C-MOS NON-INVERTING TYPE BUFFER/CONVERTER
— TOP VIEW —



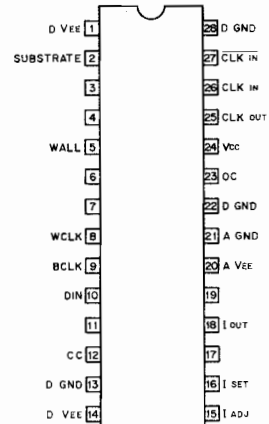
CD4051BE
MC14051BCP
TC4051BP
TP4051B
μPD4051BC
HD14051BP
C-MOS 8-CHANNEL MULTIPLEXER/DEMULTIPLEXER
— TOP VIEW —



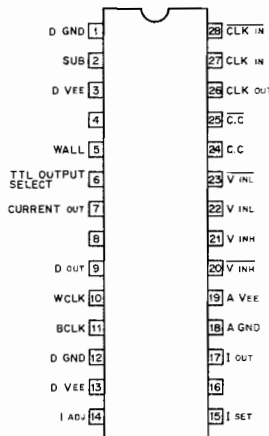
CD4077BE
MC14077BCP
MB84077B
C-MOS EXCLUSIVE NOR GATE
— TOP VIEW —



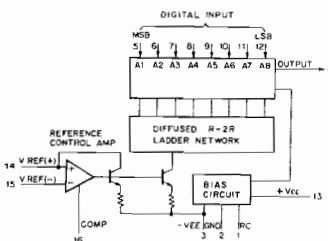
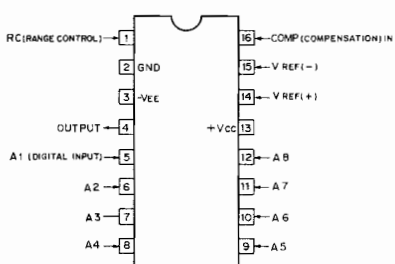
CX-890
16 bit D/A CONVERTER (PCM)
— TOP VIEW —

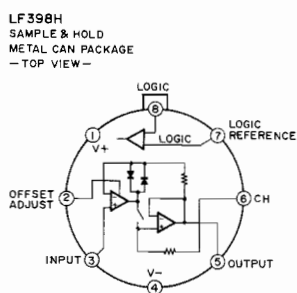
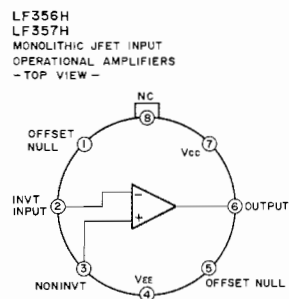
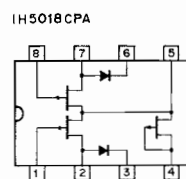
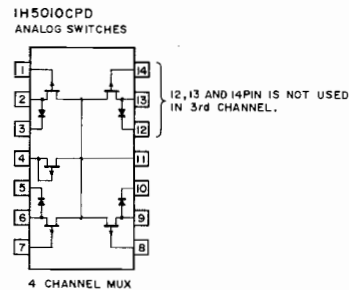
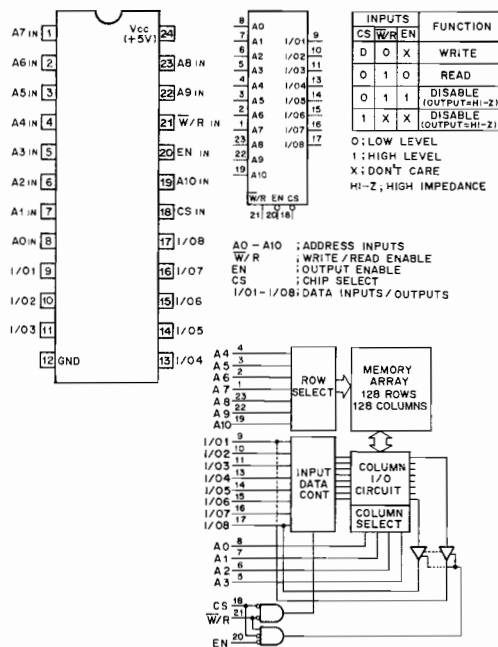


CX-899
A/D CONVERTER (PCM)
— TOP VIEW —

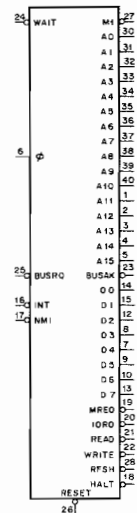
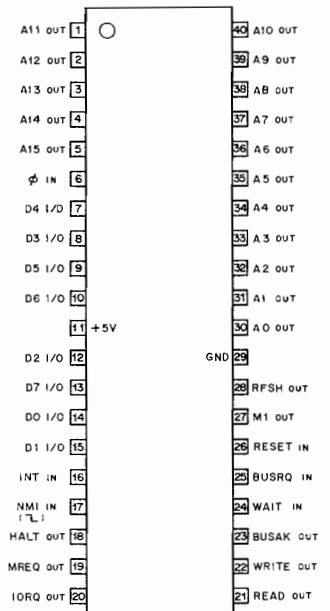


DAC-1C88C (DATEL)
8-BIT DIGITAL-TO-ANALOG CONVERTER
— TOP VIEW —

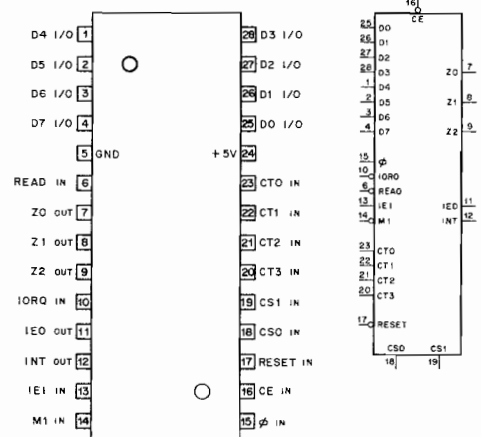




LH0080
LH0080A
μPD780C
μPD780C-1
Z80
Z80A
N-MOS 8-BIT MICROPROCESSOR
- TOP VIEW -



LH0082A
Z80-CTC
Z80A-CTC
N-MOS COUNTER TIMER CIRCUIT
- TOP VIEW -



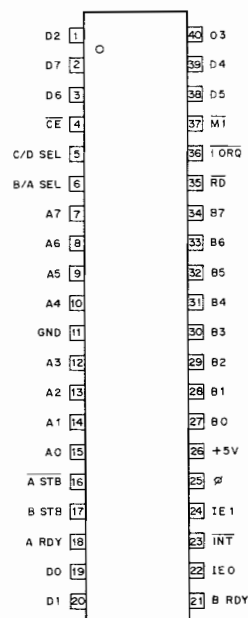
φ : SYSTEM CLOCK
CE : CHIP ENABLE
CS0, CS1 : CHANNEL SELECT
CT0-CT3 : EXTERNAL CLOCK/TIMER TRIGGER
D0-D7 : 3-STATE DATA INPUT/OUTPUT
IEI : INTERRUPT ENABLE INPUT
IEO : INTERRUPT ENABLE OUTPUT
INT : INTERRUPT REQUEST (OPEN DRAIN)
IORQ : I/O REQUEST
M1 : MACHINE CYCLE 1
READ : READ CYCLE STATUS
Z0-Z2 : ZERO COUNT/TIME OUT

CHANNEL SELECT FUNCTION

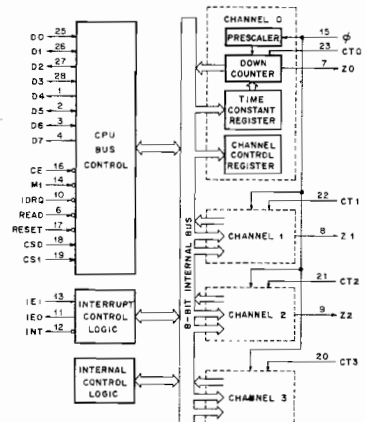
CS1	CS0	SELECTED CHANNEL
0	0	0
0	1	1
1	0	2
1	1	3

0: LOW LEVEL
1: HIGH LEVEL

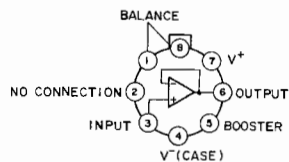
LH0081A (PIO)
- TOP VIEW -



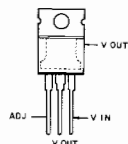
SYMBOL	NAME
D0~D7	CPU DATA BUS
B/A SEL	PORT A/B SELECT INPUT
C/D SEL	CONTROL SIGNAL/DATA INDICATING INPUT
CE	CHIP ENABLE INPUT
φ	SYSTEM CLOCK INPUT
M1	CPU MACHINE CYCLE 1
IORQ	CPU I/O REQUEST
RD	CPU READ CYCLE
IEI	INTERRUPT ENABLE INPUT
IEO	INTERRUPT ENABLE OUTPUT
INT	INTERRUPT REQUEST OUTPUT
A0~A7	PORT A BUS LINE
B0~B7	PORT B BUS LINE
A STB	STROBE PULSE
B STB	STROBE PULSE
A RDY	DATA I/O REGISTER READY
B RDY	DATA I/O REGISTER READY



LM310N

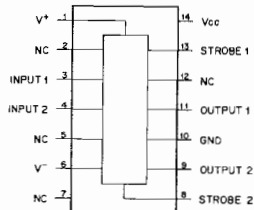


LM317T

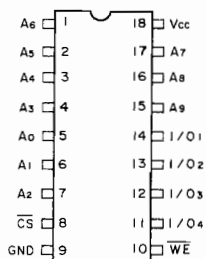


LM361N

HIGH SPEED DIFFERENTIAL COMPARATORS



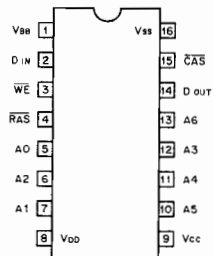
MB8114EL



MB8116E

1638-BIT DYNAMIC RANDOM ACCESS MEMORY

— TOP VIEW —



MB8114NL

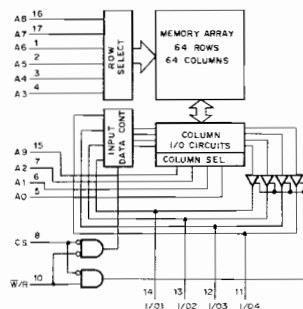
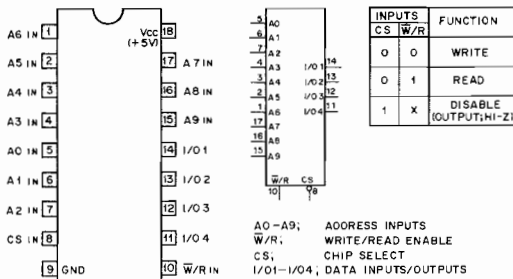
μPD444C

μPD2114LC

2114L

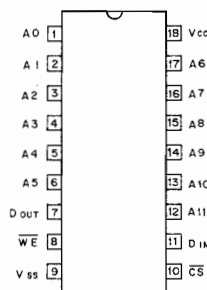
N-MOS 4096(1024X4)-BIT STATIC RAM (ACCESS TIME: 450ns)

— TOP VIEW —



MB8144NLM

— TOP VIEW —



SYMBOL	NAME	SYMBOL	NAME
A0-A11	ADDRESS INPUT	CS	CHIP SELECT
D IN	DATA INPUT	Vcc	POWER SUPPLY (+5V)
D OUT	DATA OUTPUT	Vss	POWER SUPPLY (0V)
WE	WRITE ENABLE		

Pin diagram of the 74VHC04 hex inverters. The chip has 16 pins. Pin 1 is DP8, Pin 2 is Q6, Pin 3 is Q8, Pin 4 is DP4, Pin 5 is OP3, Pin 6 is DP2, Pin 7 is DP1, Pin 8 is Vss. Pin 16 is VDD, Pin 15 is DP7, Pin 14 is DP6, Pin 13 is DP5, Pin 12 is Q7, Pin 11 is DS, Pin 10 is CLOCK, Pin 9 is P/S.

Pin diagram of the 74148 8-to-3 priority encoder. The chip has 16 pins. Pins 1-3 are labeled "SWITCHES IN / OUT" and are connected to Z1, Z0, and ZI respectively. Pins 4-7 are labeled "COMMONS OUT / IN" and are connected to 4, 15, 14, and 13 respectively. Pins 8-11 are labeled "CONTROLS" and are connected to VDD (8), VSS (9), VEE (10), and A (11). Pins 12-15 are labeled "INHIBIT" and are connected to X (12), Y (13), and Z (14).

5	1	1	1	0; LOW LEVEL
7	X	1	Qo	1; HIGH LEVEL
X	X	0	0	X; DON'T CARE

—TOP VIEW—

INPUTS		OUTPUTS	
SD	T	D	Qn Qn
1	0	X	1 0
1	1	X	X 0
0	1	X	X 1
0	0	1	1 0
0	0	1	0 1
0	0	0	0 1
0	0	0	X 0
0	0	0	X 1

0; LOW LEVEL
1; HIGH LEVEL
X; DON'T CARE
ND; NOT DEFINED

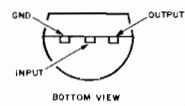
0; LOW LEVEL
1; HIGH LEVEL
X; DON'T CARE
ND; NOT DEFINED

The schematic diagram shows an 8-bit DAC with inputs 1-8 and outputs 14-8. The transfer characteristics graph plots Output Voltage against Input Voltage, showing a staircase-like response with three levels corresponding to input voltages of 0.4V, 0.45V, and 0.90V.

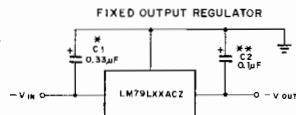
PCP OUT	1	16	VDD
PC I OUT	2	15	Z _{ENER}
PCB IN	3	14	PCA IN
VCO OUT	4	13	PC2 OUT
Inh	5	12	R2
C1A	6	11	R1
C1B	7	10	SF OUT
VSS	8	9	VCO IN

MC79L05ACZ

TO-92 PLASTIC PACKAGE(Z)

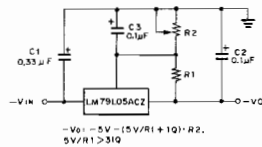


ORDER NUMBERS
LM79L05ACZ LM79L18ACZ
LM79L12ACZ LM79L24ACZ
LM79L15ACZ



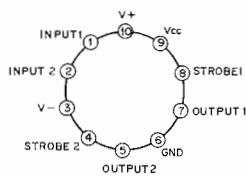
* REQUIRED IF THE REGULATOR IS LOCATED FAR FROM THE POWER SUPPLY FILTER. A 1µF ALUMINUM ELECTROLYTIC MAY BE SUBSTITUTED.
** REQUIRED FOR STABILITY. A 1µF ALUMINUM ELECTROLYTIC MAY BE SUBSTITUTED.

ADJUSTABLE OUTPUT REGULATOR



NE529H

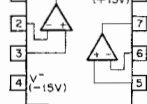
- TOP VIEW -



NJM4560D

OPERATIONAL AMPLIFIER

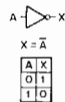
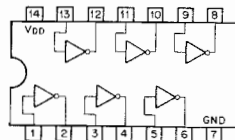
- TOP VIEW -



TC40H004P

C-MOS INVERTER

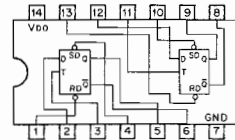
- TOP VIEW -



TC40H074P

C-MOS HIGH SPEED D-TYPE FLIP-FLOP WITH DIRECT SET/RESET

- TOP VIEW -

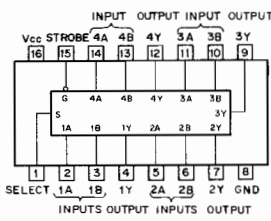


D	Q	Q'
0	0	1
0	1	0
1	1	0

RD	SD	Q	Q'
0	0	1	1
0	1	0	1
1	0	1	0
1	1	D-MODE	D-MODE

Q: LOW LEVEL
1: HIGH LEVEL

TC40H157P



TC40H174P

SN74174N

SN74S174N

SN74LS174N

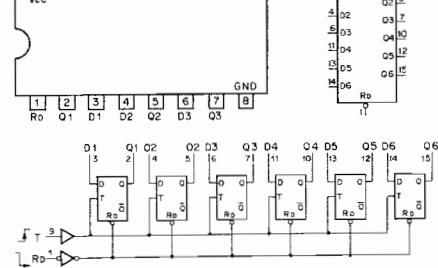
HD74LS174P

MB74LS174

M74LS174P

TTL D-TYPE FLIP-FLOP WITH DIRECT RESET

- TOP VIEW -



EACH FLIP-FLOP

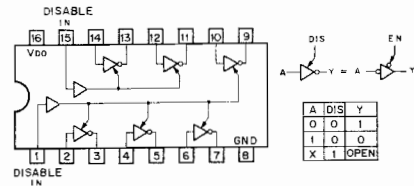
INPUTS		OUT	
RD	T	D	Q
0	X	X	0
1	0	Q	Q
1	1	1	1
1	0	X	Q'

0: LOW LEVEL
1: HIGH LEVEL
X: DON'T CARE

TC40H368P

C-MOS INVERTING 3-STATE BUFFER

- TOP VIEW -

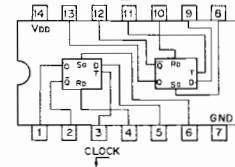


A	DIS	Y
0	0	1
1	0	0
X	1	OPEN

TC4013BP

C-MOS D-TYPE FLIP FLOP WITH DIRECT SET/RESET

- TOP VIEW -

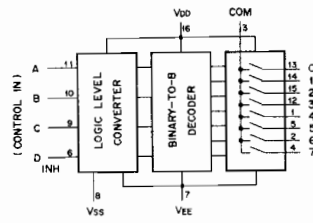


RD	SD	Q	Q'
0	0	1	1
0	1	0	1
1	0	1	0
1	1	D	Q'

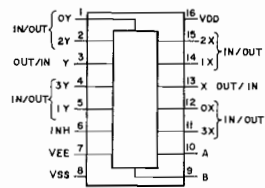
CLOCK T: 1: BEFORE CLOCK
1n+1: AFTER CLOCK

0: LOW LEVEL
1: HIGH LEVEL

SINGLE 8-CHANNEL MULTIPLEXER / DEMULTIPLEXER

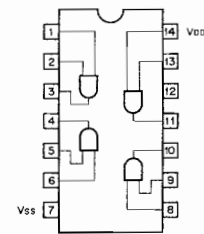


TC4052BP



TC40818P

QUAD 2-INPUT POSITIVE AND GATE



TC401758P

SN 74175N

SN74S175N

SN74LS175N

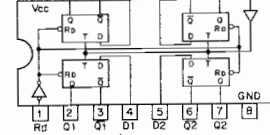
HD74LS175P

TTL D-TYPE
-TOP VIEW-

-TOP VIEW-

Q4	$\overline{Q4}$	D4	D3	$\overline{Q3}$	Q3	T
----	-----------------	----	----	-----------------	----	---

16 15 14



R_0	T	D	Q	$\bar{Q}$
Q	X	X	0	1
1	1	1	1	0
1	1	0	Q	1
1	0	X	Q_0	$\bar{Q}_0$

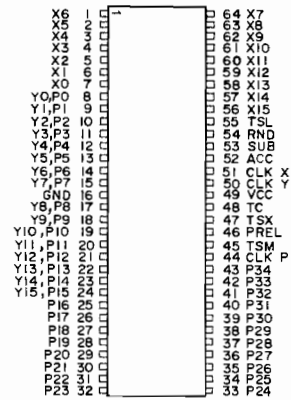
D; LOW LEVEL
1; HIGH LEVEL
X; DON'T CARE

TDC - 1010J

MULTIPLIER-ACCUMULATOR PARALLEL

16-BIT

- TOP VIEW -

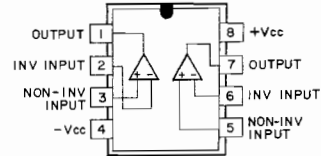


TL072CP

TLO72ACF

TL072BCR
TL082CB

TL082CP

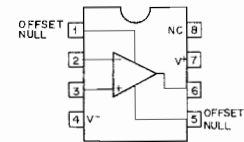


TL081CP

OPERATIONAL AMPLIFIER

(JFET INPUT)

—TOP VIEW—

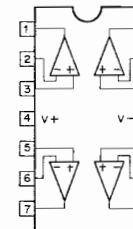


TL084CN

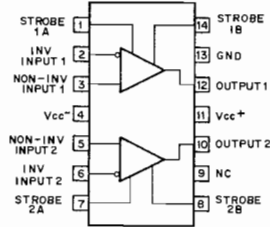
OPERATIONAL AMPLIFIER

(J FET-INPUT)

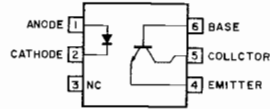
— TOP VIEW



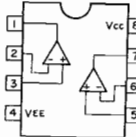
TL506CN
JORN DUAL -IN-LINE PACKAGE OR W FLAT PACKAGE
-TOP VIEW-



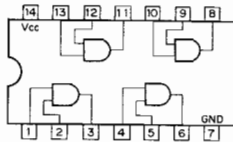
PS2003B
INTERFACE CIRCUIT



RC4558
NJM4558D
NJM4558DFA
NJM4558DMD
μPC4558C
OPERATIONAL AMPLIFIER
-TOP VIEW-



TO4H008P
SN7408N
SN74S08N
SN74LS08N
HD74LS08P
TTL 2-INPUT POSITIVE-AND GATE
-TOP VIEW-

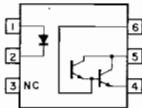


$$Y = A \cdot B = \overline{A + B}$$

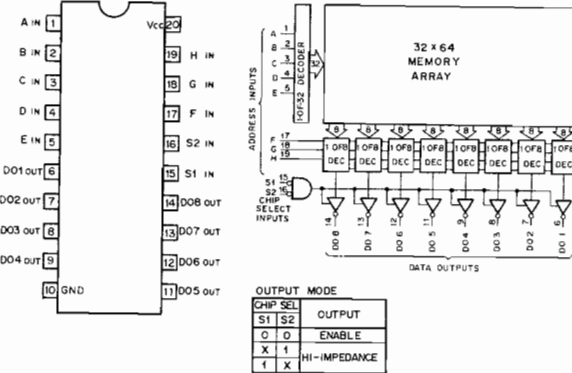
A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

0; LOW LEVEL
1; HIGH LEVEL

PC-525
PHOTOCOUPLER
-TOP VIEW-



SN74S471N
2048-BIT (256x8) PROM (3-STATE OUTPUT)
-TOP VIEW-



CHIP SEL	OUTPUT
S1 S2	ENABLE
X 1	HI-IMPEDANCE
1 X	

WORD/ADDRESS TABLE

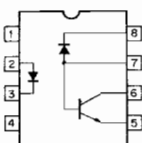
WORD	H	G	F	E	D	C	B	A
0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	1
2	0	0	0	0	0	0	1	0
...	...	...	...	...	...	...	...	...
253	1	1	1	1	1	1	0	1
254	1	1	1	1	1	1	1	0
255	1	1	1	1	1	1	1	1

DATA CODE/ACTUAL DATA

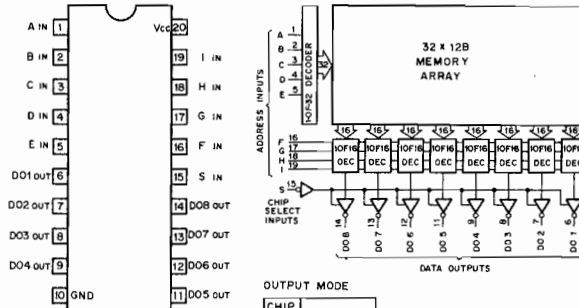
DATA CODE	DO8	DO7	DO6	DO5	DO4	DO3	DO2	DO1
0 00	0	0	0	0	0	0	0	0
1 01	0	0	0	0	0	0	0	1
2 02	0	0	0	0	0	0	1	0
...	...	...	...	...	...	...	...	...
8 08	0	0	0	0	0	1	0	0
9 09	0	0	0	0	0	1	0	1
10 0A	0	0	0	0	0	1	0	0
11 0B	0	0	0	0	0	1	0	1
12 0C	0	0	0	0	0	1	1	0
13 0D	0	0	0	0	0	1	1	1
14 0E	0	0	0	0	1	1	1	0
15 0F	0	0	0	0	1	1	1	1
16 10	0	0	0	0	1	0	0	0
17 11	0	0	0	0	1	0	0	1
...	...	...	...	...	...	...	...	...
238 EE	1	1	1	0	1	1	1	0
239 EF	1	1	1	0	1	1	1	1
240 FO	1	1	1	1	0	0	0	0
241 F1	1	1	1	1	0	0	0	1
242 F2	1	1	1	1	0	0	1	0
...	...	...	...	...	...	...	...	...
248 FB	1	1	1	1	1	0	0	0
249 FC	1	1	1	1	1	0	0	1
250 FD	1	1	1	1	1	0	1	0
251 FE	1	1	1	1	1	1	0	0
252 FF	1	1	1	1	1	1	0	1
253	1	1	1	1	1	1	1	0
254	1	1	1	1	1	1	1	1
255	1	1	1	1	1	1	1	1

IN HEXADECIMAL
IN DECIMAL

PC618



SN74S472N
TBP28S42N
 4096-BIT (512 x 8) PROM (3-STATE OUTPUT)
 —TOP VIEW—



OUTPUT MODE

CHIP SEL	OUTPUT
S	ENABLE
1	HI-Z

0; LOW LEVEL
 1; HIGH LEVEL
 HI-Z; HIGH IMPEDANCE

WORD/ADDRESS TABLE

WORD	1	H	G	F	E	D	C	B	A
0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	1
2	0	0	0	0	0	0	0	1	0
...	...	...	...	...	...	...	...	...	...
509	1	1	1	1	1	1	1	1	0
510	1	1	1	1	1	1	1	1	1
511	1	1	1	1	1	1	1	1	1

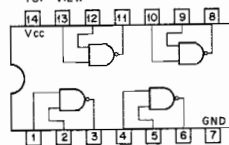
0; LOW LEVEL
 1; HIGH LEVEL

DATA CODE/ACTUAL DATA

DATA CODE	DO8	DO7	DO6	DO5	DO4	DO3	DO2	DO1
0	0	0	0	0	0	0	0	0
1	0	1	0	0	0	0	0	1
2	0	2	0	0	0	0	1	0
...	...	...	...	...	...	...	...	...
8	0	8	0	0	0	1	0	0
9	0	9	0	0	0	1	0	1
10	0	0	0	0	0	1	1	0
11	0	0	0	0	0	1	1	1
12	0	0	0	0	1	1	0	0
13	0	0	0	0	1	1	0	1
14	0	0	0	0	1	1	1	0
15	0	0	0	0	1	1	1	1
16	1	0	0	0	1	0	0	0
17	1	1	0	0	1	0	0	1
...	...	...	...	...	...	...	...	...
238	1	1	1	1	0	1	1	0
239	1	1	1	1	0	1	1	1
240	1	1	1	1	0	0	0	0
241	1	1	1	1	0	0	0	1
242	1	1	1	1	0	0	1	0
...	...	...	...	...	...	...	...	...
248	1	1	1	1	1	0	0	0
249	1	1	1	1	1	0	0	1
250	1	1	1	1	1	0	1	0
251	1	1	1	1	1	0	1	1
252	1	1	1	1	1	1	0	0
253	1	1	1	1	1	1	0	1
254	1	1	1	1	1	1	1	0
255	1	1	1	1	1	1	1	1

IN HEXADECIMAL
 IN DECIMAL

74F00PC
SN7400N
M53200P
SN74S00N
SN74LS00N
HD74LS00P
SN74ALS00N
 TTL NAND GATE
 —TOP VIEW—

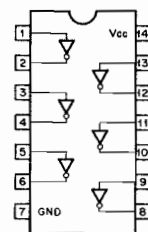


$$Y = A \cdot B = \overline{A + B}$$

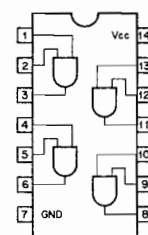
A	B	Y
0	0	1
0	1	0
1	0	0
1	1	0

0; LOW LEVEL
 1; HIGH LEVEL

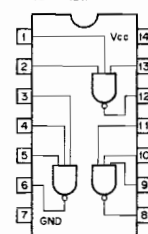
74F04PC
HEX INVERTER
 —TOP VIEW—



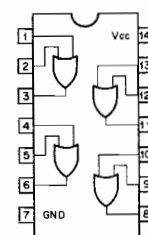
74F08PC
QUAD 2-INPUT AND GATE
 —TOP VIEW—



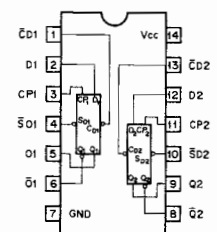
74F10PC
TRIPLE 3-INPUT AND GATE
 —TOP VIEW—



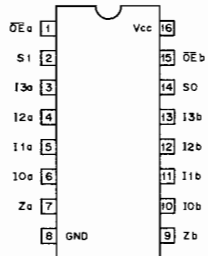
74F32PC
QUAD 2-INPUT OR GATE
 —TOP VIEW—



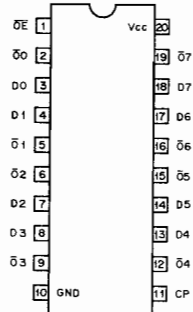
74F74PC
DUAL D-TYPE POSITIVE EDGE-TRIGGERED FLIP-FLOP
 —TOP VIEW—



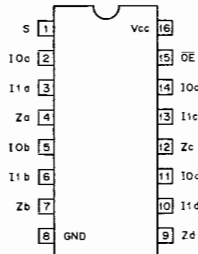
74F253PC
DUAL 4-INPUT MULTIPLEXER
(WITH 3-STATE OUTPUTS)
— TOP VIEW —



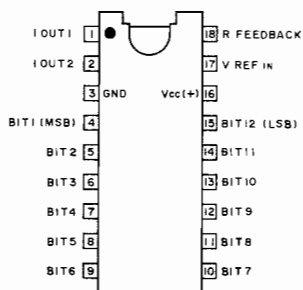
74F534PC
OCTAL D-TYPE FLIP-FLOP
(WITH 3-STATE OUTPUTS)
— TOP VIEW —



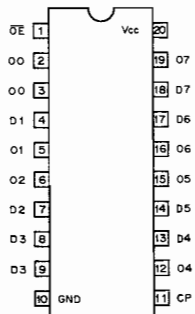
74F257PC
QUAD 2-INPUT MULTIPLEXER
(WITH 3-STATE OUTPUTS)
— TOP VIEW —



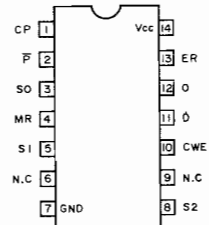
7541C
CMOS 12-BIT MULTIPLYING D/A CONVERTERS
— TOP VIEW —

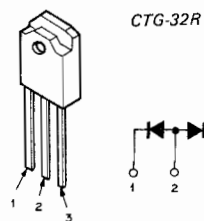
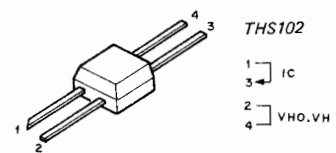
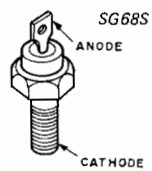
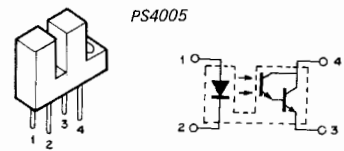
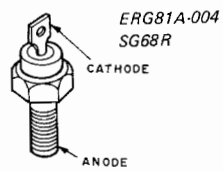
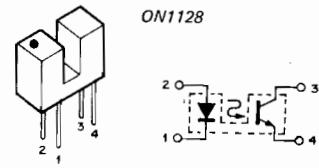
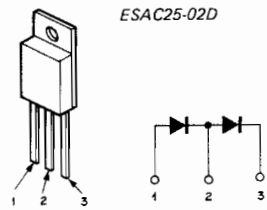
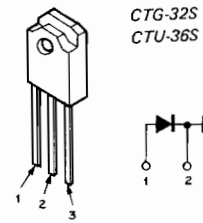
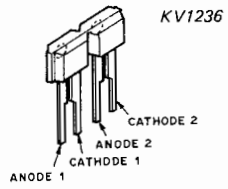


74F374PC
OCTAL D-TYPE FLIP-FLOP
(WITH 3-STATE OUTPUTS)
— TOP VIEW —



9401PC
CRC GENERATOR / CHECKER
— TOP VIEW —





SONY®

AUDIO MULTI-CHANNEL RECORDER

PCM-3324



SUPPLEMENT-4

This supplement contains the following information.

- Section 2 System Outline
- Section 3 Service Information
- Section 4 Periodic Inspections and Maintenance
- Section 5 Replacement and Adjustment of Mechanical Components
- Section 6 Electrical Adjustment

Please file this supplement with your PCM-3324 Operation and Maintenance Manual 1st Edition to 3rd Edition Revised 5.

DIGITAL Professional OPERATION AND MAINTENANCE MANUAL

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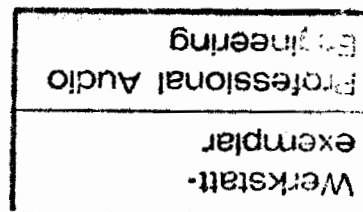




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SECTION 2

SYSTEM OUTLINE

2.1 Synchronization System of the PCM-3324

The PCM-3324 can be operated in synchronization with the operating reference signal generated by its master clock (internal synchronization), or with an externally generated signal (external synchronization). The following may be used as the external synchronization signal: word sync signal, video vertical synchronization signal, film synchronization signal, and power-line synchronization signal.

Word-sync Synchronization

The word-sync signal is the synchronization signal used for synchronization with external equipment; it is used when building a system using PCM-3324s. Although the PCM-3324 also has a sector-sync signal that serves as a synchronization signal, the sector-sync signal is the reference signal for reading out sector addresses and cannot be used for synchronizing a PCM-3324 and other connected equipment.

When a PCM-3324 is controlled with an RM-3310 remote control system, the PCM-3324 automatically enters the word-sync mode when set to the slave mode, and the word-sync input terminal of the slave RM-3310 serves as the word-sync input terminal of the controlled PCM-3324 via its REMOTE 3 terminal. If the master PCM-3324/RM-3310 and the slave PCM-3324/RM-3310 are properly connected, the slave PCM-3324 will be synchronized with the word-sync of the master PCM-3324.

Video Vertical Synchronization

Video vertical synchronization is necessary when operating the PCM-3324 with VTRs and other similar equipment that handle video signals.

Video vertical synchronization signals of the following frequencies may be used:

NTSC: 30Hz and 29.97Hz

PAL/SECAM: 25Hz.

Film Synchronization

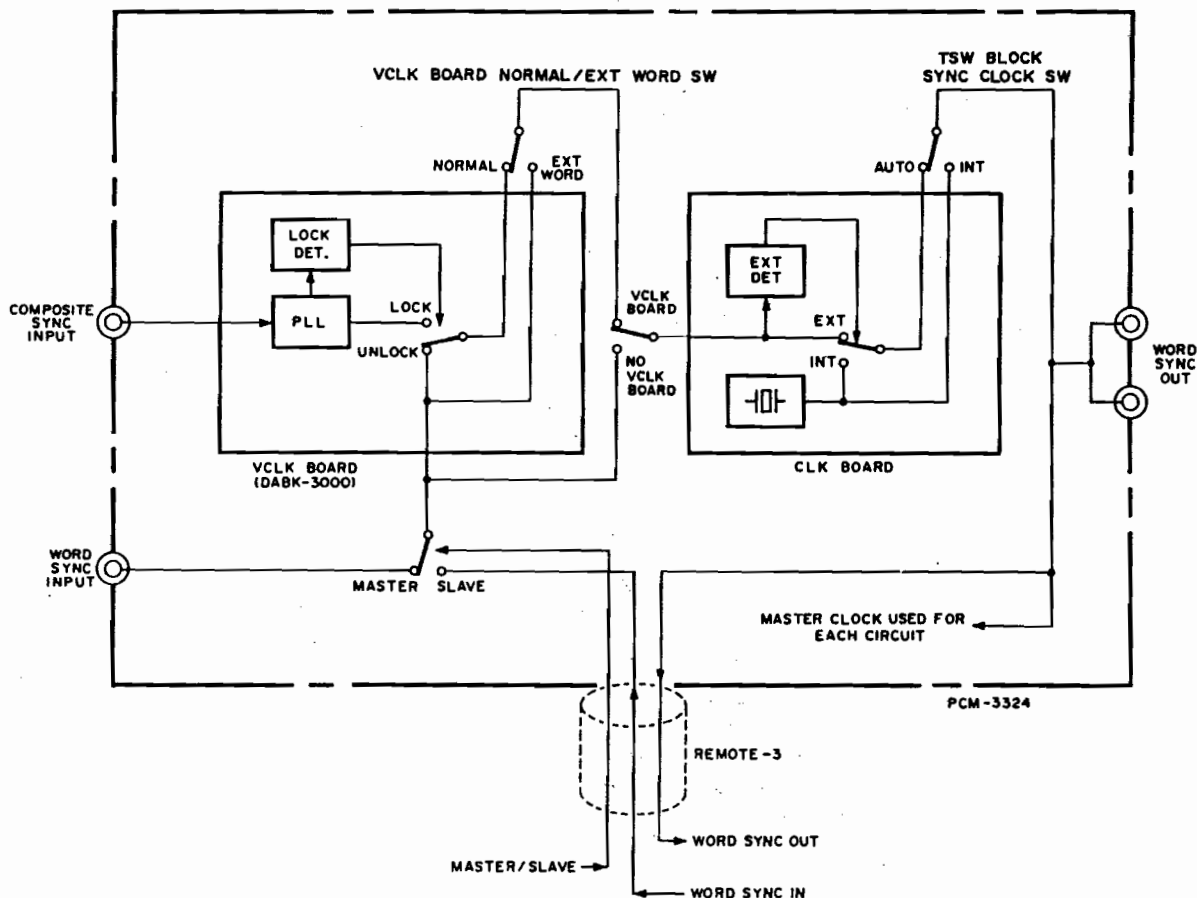
Film synchronization is necessary when operating the PCM-3324 in conjunction with film equipment. 24Hz and 25Hz rectangular wave signals can be used.

Power-line Synchronization

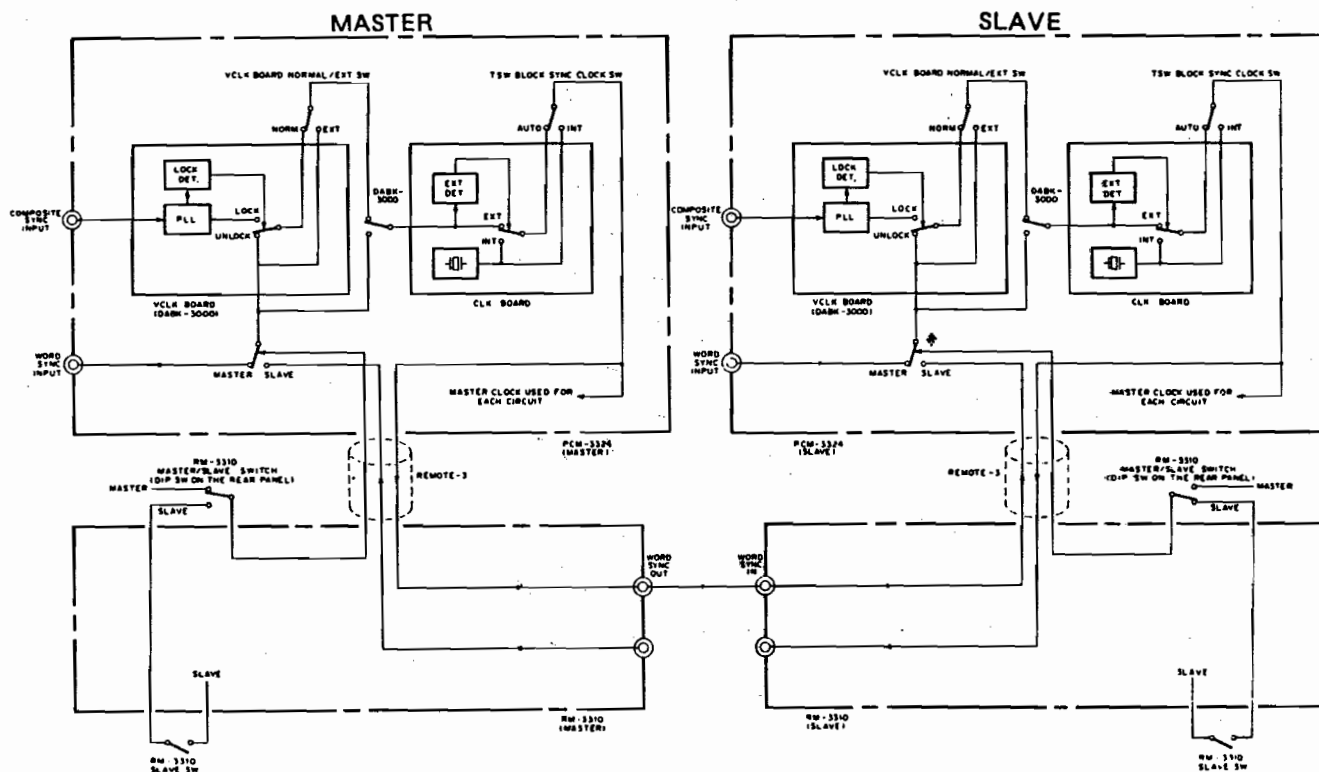
Power-line synchronization must be used when synchronizing equipment with the frequency of the power supply (e.g., when using the PCM-3324 with power-line synchronization film cameras and projectors). 50Hz and 60Hz rectangular wave signals can be used.

Note: The optional DABK-3000 Video Clock Board is necessary when using video vertical synchronization, film synchronization, or power-line synchronization. Furthermore, the equipment may not synchronize in cases of power-supply frequency variations or imprecision. Please refer to the DABK-3000 Operation and Maintenance Manual for details.

Synchronization Control Block Diagram



Synchronization Control Setup when using RM-3310s



*: Once the slave PCM-3324 has entered the slave mode, the slave mode cannot be released.

22 Tape Transport Control

22.1 Tape Transport Control Signal Flow

Tape transport control signals are handled by the following three input systems: the function key input system, the analog shuttle input system, and the REMOTE1 direct input system.

Input from the function keys goes to the KY board, whence it passes to the MCPU board, then to the LOC board, and finally to the SYS board, where signals indicating which key or keys have been pressed are transmitted to Servo Processing section.

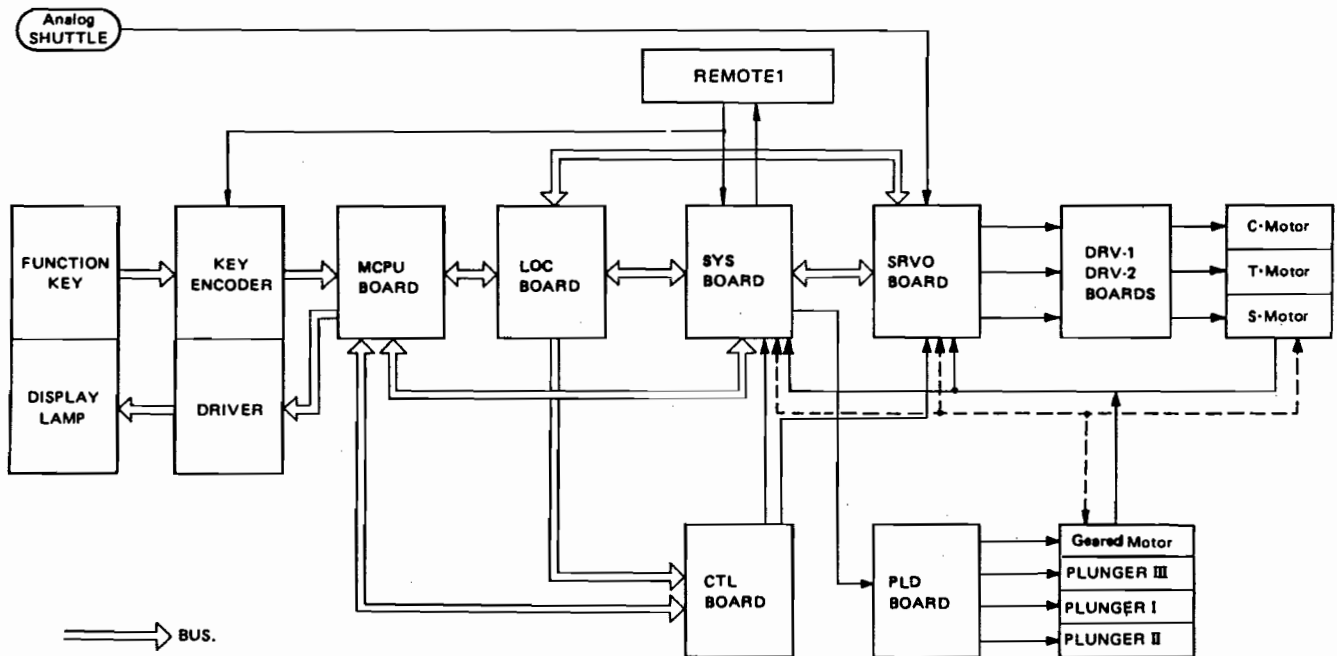
Input from the analog shuttle is transmitted to the LOC board, via the shuttle interface circuit, then to the SYS board, where signals are transmitted to the Servo Processing Section.

Function of the LOC Board

The LOC board decides the operation mode and other appropriate transport system status according to key information received from the MCPU, and it communicates the machine status from the SYS board to the MCPU.

Furthermore, the LOC board reads the sector addresses on the tape from the CTL board, converts into serial format, and outputs them.

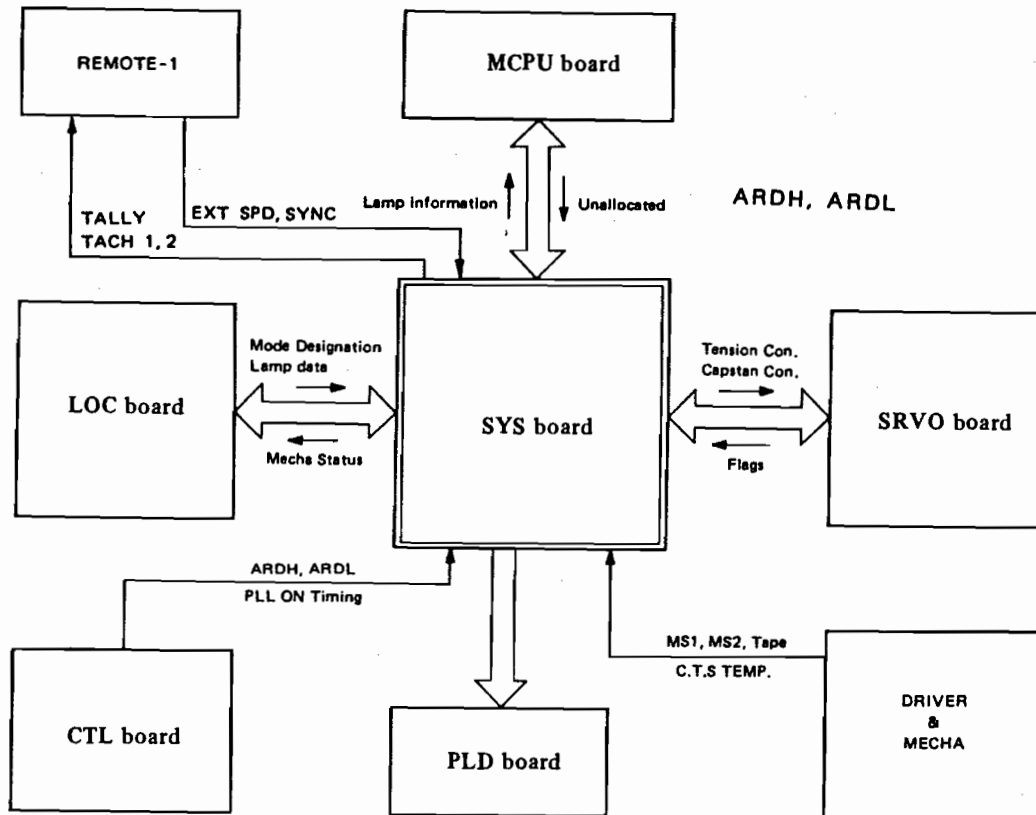
In the synchronized mode, the LOC board also reads the serial sector address data from the master unit, compares the sector addresses on the tape while following the master unit, and outputs LOCK commands to the CTL board.



Tape Transport Control Signals Block Diagram

222 SYS board I/O

The SYS board is interfaced with the LOC, MCPU, and SRVO boards via independent 8-bit bi-directional buses.



SYS Board I/O

Data input and output by the SYS board:

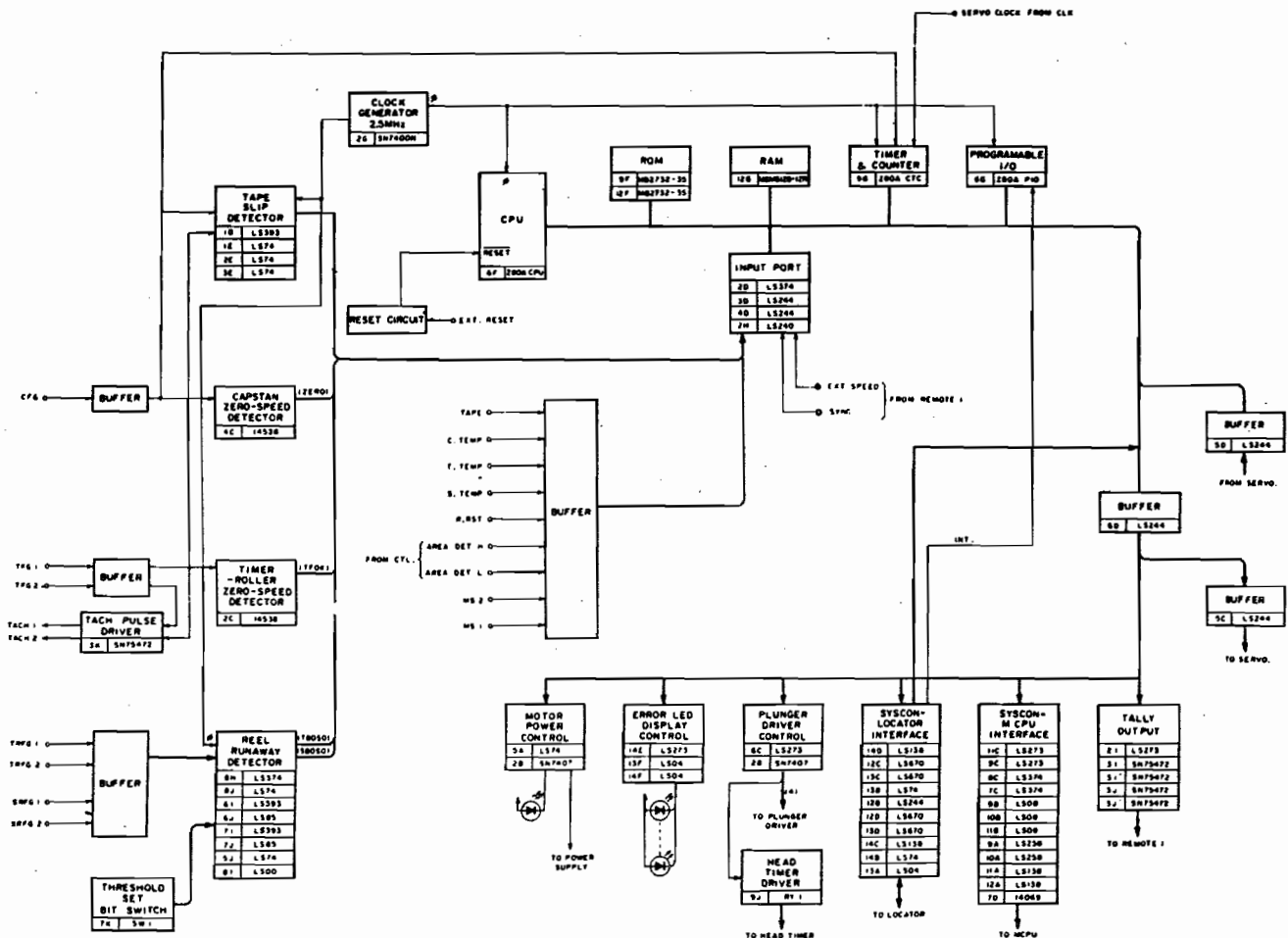
- (1) REMOTE1 TALLY I/O
- (2) Lamp data
- (3) Mode designation
Lamp status (ON/OFF) data
- (4) Machine status
- (5) Tension control
Capstan control
Speed servo—phase servo mode switching
- (6) Machine status including rotating direction of the capstan
- (7) The following are input from CTL board sensors:
ARDH & ARDL: PLL switching timing during PLAY.
- (8) The following are output to the PLD board: solenoid status (ON/OFF) signals, geared motor (motor for retracting the tension arm) status (ON/OFF) signals.

- (9) Input of tape transport information
C TEMP: Abnormal capstan motor temperature
T TEMP: Abnormal take-up motor temperature
S TEMP: Abnormal supply motor temperature
TAPE: Presence of tape (used as a shut-off signal)
MS1: Geared motor position sensor (arm release position sensor)
MS2: Geared motor position sensor (arm retract position sensor)

In addition to the I/O of the items listed above and shown in the diagram, the SYS board directly inputs and outputs the following:

- Drive signals for the eight LEDs comprising the error message indicator on the SYS board.
- Signals for turning the HEAD TIMER HOUR METER on and off.
- Signals for turning power to the motor on and off.

223 SYS Board Circuits



SYS Board Block Diagram

The SYS board can be divided into the following blocks according to function:

- (1) CPU unit
- (2) Oscillator circuit
- (3) Capstan-tape slip detector
- (4) SYS board-LOC board interface circuit
- (5) SYS board-MCPU board interface circuit
- (6) SYS board-SRVO board interface circuit
- (7) Solenoid control circuit
- (8) Capstan-speed zero-detector
- (9) Timer roller-speed zero-detector
- (10) Mechanism flag input interface circuit
- (11) Error display circuit
- (12) 10ms timing generator and capstan speed detector
- (13) Head timer drive circuit
- (14) Motor power ON/OFF circuit

Explanations of each block follow.

(1) CPU unit

CPU: Z80A

ROM: Intel 2732 or equivalent X 2 (8kBytes)

RAM: C-MOS MSM5128-12R or equivalent X 1 (2kBytes)

(2) Oscillator circuit

The oscillator circuit uses a 5MHz crystal to generate a 2.5MHz clock pulse that serves as the CPU clock, the slip detector clock, Z-80CTC (timer LSI) clock, and the Z-80PIO clock.

(3) Capstan-tape slip detector

The tape may slip along the capstan when tape tension becomes unbalanced. The slip detector detects that slip and corrects tape tension by determining the correction volume from the ratio of FG pulses to timer FG pulses and inputting the correction volume to the slip correction D/A converter on the SRVO board.

(4) SYS board-LOC board interface circuit

The SYS board-LOC board interface circuit has a common 4-byte register for each direction; handshakes are performed by interrupt.

(5) SYS board-MCPU board interface circuit

The function of the SYS board-MCPU board interface circuit is to send the function key lamp control (ON/OFF) signals to the MCPUR board; this circuit also handles the function key status (ON/OFF) signals.

(6) SYS board-SRVO interface circuit

The SYS board-SRVO interface circuit comprises an 8-bit bi-directional bus with a register on the servo board, and controls capstan speed, rates of acceleration and deceleration, tape tension, and servo mode (speed servo/phase servo). Because of the critical nature of this circuit to mechanism control, a self-diagnostic program checks to verify correct connection of the bus when the power is switched ON.

(7) Solenoid control circuit

The SYS board controls the geared-motors (motors that move the tension regulator), and the reel-motor-brake plunger and shift-roller plunger (plungers I and II) via the PLD board. Signals are sent in 4-bit parallel form to the plunger drivers.

(8) Capstan-speed zero-detector

The capstan-speed zero-detector detects, by means of the capstan FG signal, the rotating speed of the capstan and outputs the ZERO signal when the capstan nears standstill. The ZERO signal changes the servo mode.

(9) Timer roller-speed zero-detector

The timer roller-speed zero-detector detects, by means of the timer FG signal, the rotating speed of the timer roller when it becomes $> X 1$.

(10) Mechanism flag input interface circuit

Several mechanism status flags are directly input to the SYS board through its I/O:

C TEMP: Abnormal capstan motor temperature

T TEMP: Abnormal take-up motor temperature

S TEMP: Abnormal supply motor temperature

TAPE SENSOR: Tape-end detection

MS1 & MS2: Tension regulator position detection

AREA DET H, L: Capstan speed within $\pm 3\%$ of FWD

(11) Error display circuit

The error display circuit causes the eight LEDs comprising the error indicator to illuminate in patterns that correspond to the error detected by the system's self-diagnostic program.

(12) 10ms timing generator and capstan speed detector

The 10ms timing generator and capstan speed detector uses the pulse from the Z80 CTC to generate the 10ms timing in which an interrupt is applied to the CPU to execute routines such as the following:

- 1) Slip servo sampling
- 2) Clearing of the counter used for detecting capstan speed
- 3) Verification of the servo lock frequency
- 4) Self-diagnostic programs for checking TD (tape direction) and abnormally low tape tension.

(13) REMOTE1 interface circuit (TALLYs and TACH1, 2 outputs)

The REMOTE1 interface circuit comprises the TALLY output circuit and TACH pulse driver.

(14) Head timer drive circuit

The head timer drive circuit activates the Hour meter of the mercury timer located on the rear panel; this timer measures actual PLAY execution time.

(15) Motor power control circuit

The motor power control circuit turns on and off the power supply to the capstan driver and reel driver motors.

224 Functions of the SYS Board

Following POWER ON RESET at power on, the SYS board initializes the system and executes self-diagnostic program I. Self-diagnostic program I checks the SYS board-SRVO board interface circuit, the RAMs, and the 15V power supply system. If no abnormalities are discovered, the system enters normal operation; if abnormalities are encountered, the error message appropriate to the abnormality mode is displayed on the error indicator.

Following successful execution of self-diagnostics I, the SYS-board activates servo-control, the SYS board-LOC board interface, and lamp control, then it executes self-diagnostics program II.

SRVO control controls capstan speed, the rate of capstan acceleration/deceleration, tape tension, and the plungers to achieve the target machine status determined by INT2, which will be described later.

The SYS board-LOC board interface sends machine status information back to the LOC board.

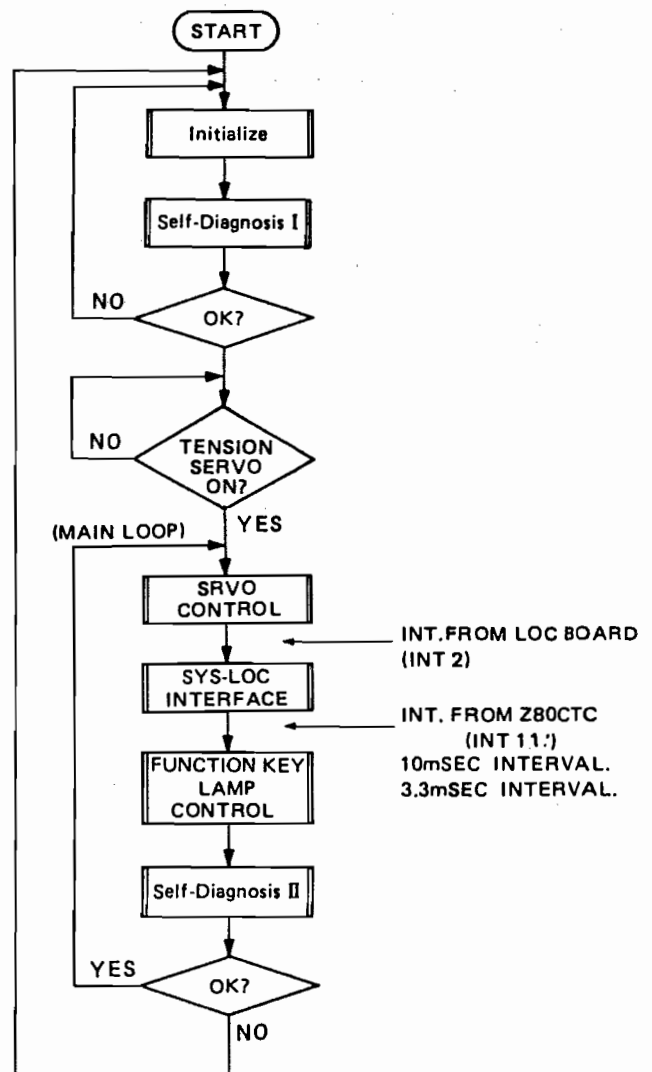
Function key lamp control determines the lamp status (ON, OFF, or flashing) according to the command from the LOC board and the machine status, and sends the lamp status data to the MCPU.

Self-diagnostic program II checks the power supply ($\pm 15V$) system, the servo lock, speed over, arm lock, motor temperature, tape tension, capstan speed (in the case of the last three, expressly for abnormally high temperature, abnormal tension, and excessive speed). If abnormalities are discovered, the shut-off signal is output and the appropriate error information is displayed on the error indicator. The main loop is repeated when no abnormalities are detected.

Interrupts from the LOC board are received through the Z80PIO and applied to the SYS board CPU. The CPU decides whether the mode designation format is correct or not: if correct, the target mechanism status register is updated; if incorrect, the mode designation (INT2) is ignored.

Moreover, interrupts are applied to the CPU from the Z80CTC on the SYS board at intervals of 10ms and 33ms, and the following routines are executed in 10ms timing:

- SPDET: detects capstan speed.
- FRMDET: checks whether the servo clock is being correctly input, and outputs an OK flag when it is.
- SLIPSV: adjusts tape tension according to slip data supplied by the slip detector.
- TD CHECK: checks the rotating direction of the reels, capstan, and timer roller.
- TR CHECK: checks whether tape is threaded on the tension regulator.
- LTEN: checks for abnormally low tape tension.
- RCMASK: stops the reel-runaway detector upon receipt of a shift roller transient.



Tape Transport Control Sequence Main Flowchart

225 SRVO Board Circuits

The SRVO board comprises ten blocks; the names of the signals used by each block are given in the timing charts at the end of this section.

Block 1 (Tension servo circuits)

The tension servo block (circuits) comprises the supply-side (S) circuit and the take-up-side (T) circuit, each of which functions independently. Since the structure of both circuits is identical, only one of them is explained below.

(1) Buffer amp and filter

The buffer amp and filter remove noise from the output signal arriving from the tension sensors (secondary low-pass filter).

(2) Tension setting voltage selector

The tension setting voltage selector adjusts the setting voltage according to the take-up and supply tension control signals.

The take-up tension control signal (T) is a single-bit signal configured as follows: 0 = take-up HIGH tension, 1 = take-up LOW tension;

the supply tension control signal (S) is a 2-bit signal configured as follows: 00 = supply HIGH tension, 01 = supply LOW tension, 10 = supply tension FWD.

(3) Tension error amplifier

The error amplifier circuit detects error voltage of the T (S) tension value and the set tension values. It comprises the selector controlled by the TEN (tension servo enable) signal and an adder and phase compensating amplifier.

(4) Tension servo enable relay

The tension servo enable relay is located on the SRVO board and is used to apply the servo to the tension. It is activated by the TEN signal.

(5) LOW/HIGH tension detector

The LOW/HIGH tension detector monitors the signals from the tension sensors to detect excessively low or high tension. The detection signals are output to the SYS board I/O.

(6) Acceleration compensator

The acceleration compensator supplies compensation to improve follow-up at acceleration (deceleration) of the tape transport system. This compensation is made by applying the tension servo system with the voltage proportional to the acceleration rate that is obtained by differentiating the CV* signal.

CV* signal: Capstan voltage control signal

(7) Imaginary ground

The imaginary ground functions to suppress power supply ($\pm 5V$ regulator) drift and noise.

Note: The imaginary ground has been specially added as a ground for the tension servo circuit and is different from the normal power supply ground.

(8) T (S) DA converter signal

When a slip results from the discrepancy of the tension caused at acceleration or deceleration, the SYS board detects the slip and applies a volume proportional to the slip to the tension servo circuit. Thus, uniform tension is always maintained regardless of the mode.

(9) Miscellaneous

The tension servo can be turned on and off by means of the tension servo switch (TEN SW).

Block 2 (Frequency voltage circuit)

Block 2 is a high precision frequency voltage converter circuit specifically used for the servo system in the play mode. This circuit includes sample-and-hold FV converters, which are structurally different from conventional monomulti FV converters. Carrier leakage is much less than with monomulti FV converters; consequently, high-precision low-drift is achieved by using two identical FV converters.

Block 2 comprises the constituent circuits described below.

(1) Buffer and FG pulse shaper

(2) FV converters (two sample-and-hold type)

One of the FV converters generates a voltage corresponding to the capstan speed; and the other, a voltage corresponding to the master clock frequency.

- o The capstan FG frequency in the PLAY mode is as follows according to the sampling frequency (fs): 2,000Hz when fs=48kHz, 1837.5Hz when fs=44.1kHz.

(3) Differential amplifier

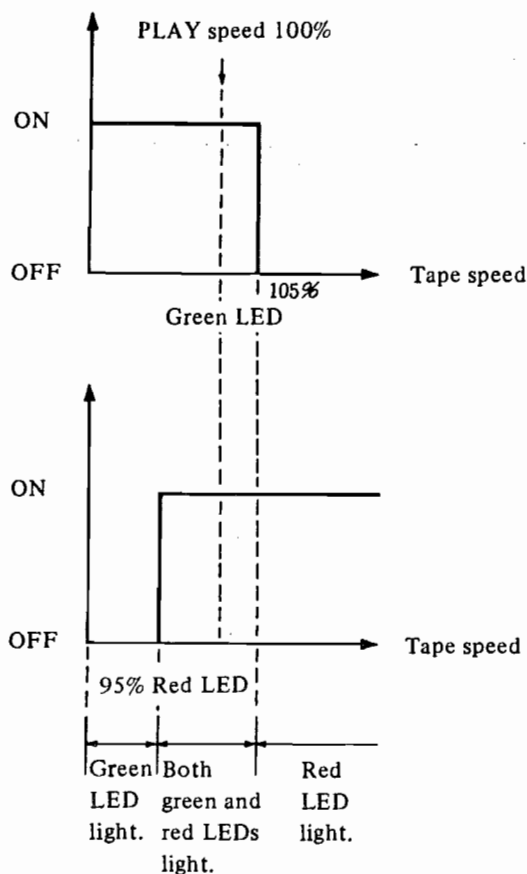
The differential amplifier generates a voltage corresponding to the difference between the outputs of the two FV converters (described above) and sends this voltage to the next stage, the capstan servo amp, as the capstan motor speed error during play operations.

(4) Reverse rotation preventing circuit

Because the polarity of the speed-detection FV converters used in this unit does not become inverted when the direction of rotation changes, they can cause the capstan motor to race in the direction opposite that of reel rotation in the PLAY mode. This circuit is provided to prevent such reverse rotation.

(5) ARDH and ARDL flag detector

Two LEDs illuminate, simultaneously or separately depending on tape speed (capstan rpm) as depicted by the illustration below, when the PCM-3324 is in the play mode; the red one corresponds to ARDH; the green one, to ARDL.



Block 3 (FVC circuit)

Block 3 is the FV converter circuit used to control capstan motor speed in all operating modes other than the PLAY mode (that is FF, REW, SHUTTLE, etc.). It outputs 10V when the tape speed is 14m/sec. The output voltage is sent to the capstan driver (DRV-1) and is used as the signal that controls the power supply voltage.

Block 4 (FG amplifier circuit)

Block 4 wave-forms the sine waves from the capstan FG circuit and comprises the constituent circuits described below.

(1) Differential amplifier

The differential amplifier eliminates in-phase noise in the FG signals.

(2) Switchable low pass/high pass filter

The switchable low pass/high pass filter is designed to switch to low or high pass according to the capstan speed in order to eliminate noise superimposed on the capstan FG output. Switching is effected by the voltage of the CV signal; the switching point is the CV signal value corresponding to CV=1V at capstan FG frequency 3,000Hz. The filter functions as a high pass filter at values of 1V and higher (at capstan FG frequency 3000Hz or more), and as a low pass filter at values of less than 1V (at capstan FG frequency 3,000Hz or less). Hysteresis is used in determining the switching point to make stable switching possible.

Block 5 (Rate controller, or curve generator)

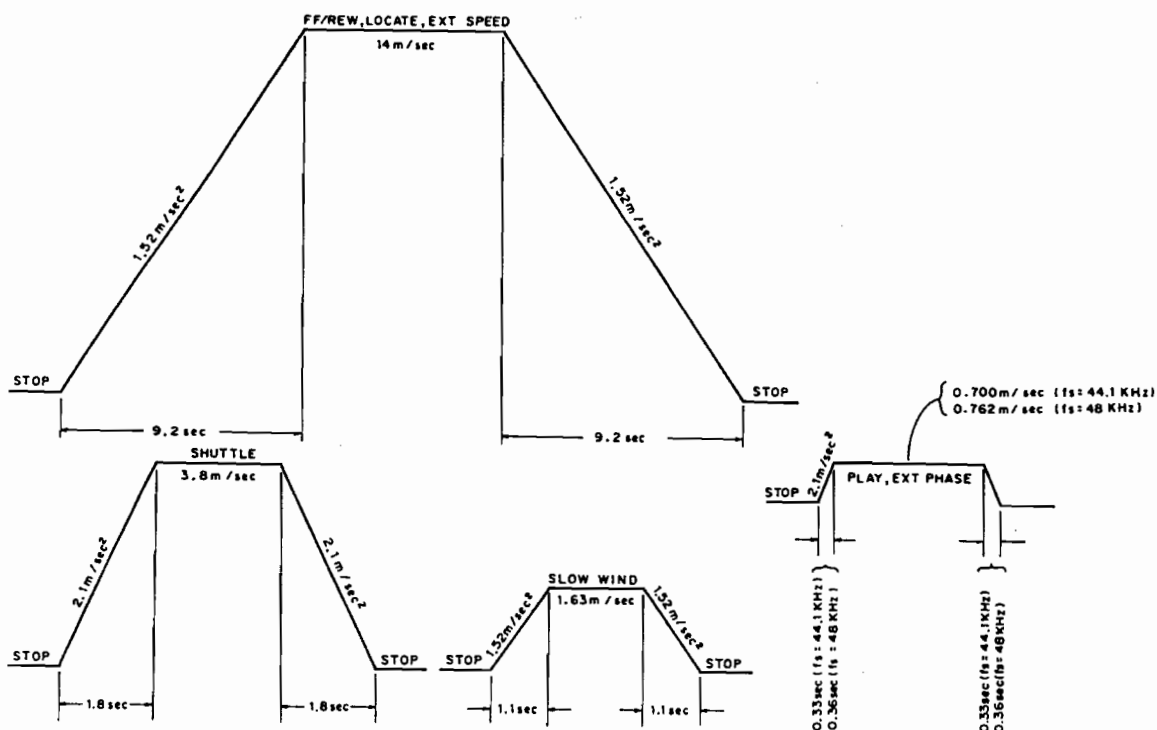
Block 5 prevents excessive acceleration and deceleration of the motor. The RSL (reel speed limiter) signal voltage, which is equivalent to the set speed value, changes to step form; this block is used to suppress the rate of change to one corresponding to the allowable rate of acceleration. This rate of change is selected by the 3-bit CRV digital control signal (control word) generated by the circuit.

Mnemonic	Control word CRV2 CRV1 CRV0			Voltage acceleration	Setting time
RST	0	0	0	—	—
OVER	0	0	1	1.09V/S ²	9.1 SEC TO FF/REW
TH1	0	1	0	0.79V/S ²	12.3 SEC TO FF/REW
TH2	0	1	1	0.79V/S ²	12.3 SEC TO FF/REW
FWF	1	0	0	1.5V/S ²	0.35 SEC TO FWD
FWR	1	0	1	1.5V/S ²	0.35 SEC TO FWD
FRF	1	1	0	1.09V/S ²	9.1 SEC TO FF/REW
FRR	1	1	1	1.09V/S ²	9.1 SEC TO FF/REW

	Variation		Applicable mode
	Voltage	Tape speed	
RST	—	—	At shut off
OVER	1.09V/S ²	1.52m/S ²	At acceleration/deceleration of tape speeds exceeding 10m/s during FF and REW operations, and during FF and REW operations.
TH1	0.79	1.11	At deceleration from FF or REW when motor overheats.
TH2	0.79	1.11	At acceleration to FF or REW when motor overheats, and during FF and REW operations.
FWF	1.5	2.1	At deceleration from play.
FWR	1.5	2.1	At acceleration to play, and during play operation.
FRF	1.09	1.52	Deceleration from FF and REW.
FRR	1.09	1.52	Acceleration to FF and REW, and during FF and REW operations.

Note 1: Acceleration and deceleration refer to the increase or decrease, respectively, of the absolute speed values.

Note 2: The temperature sensor in the motor suppresses the rate of acceleration or deceleration to 1.11m/sec² when the motor is run continuously for ten minutes or longer.



Block 6 (Slow wind selector)

Block 6 is a component of Block 9; see Block 9 for details.

Block 7 (Shuttle command gen. and status detector)

Block 7 comprises the analog circuit of the shuttle interface and the flag detector, described below.

(1) Shuttle interface analog circuit

The shuttle interface circuit has a differential amplifier in its input section to eliminate in-phase noise from the shuttle potentiometer signals. Shuttle voltage from which noise has been eliminated is lead to a voltage comparator which generates the SHUTTLE IN signal to indicate that the shuttle knob has been manipulated; SHUTTLE IN is transmitted to the LOC board via an input port provided in the I/O block. Furthermore, the shuttle voltage is applied to the next stage, the tape transport servo system, and is used as the tape speed reference voltage of the shuttle mode.

(2) Status detector

The statuses handled by the status detector indicate the operating condition of the transport control system, and are described below.

1. PDIF, NDIF (Positive/negative difference)
PDIF and NDIF indicate the status of the difference between the CV and FVC signal (voltage) values.
These are used to monitor aberrations from the set tape speed.
2. PACC, NACC (Positive/negative acceleration)
The PACC or NACC status is determined by the CGA signal output by Block 5 (rate controller); This indicates whether the acceleration rate being applied to the tape transport system is positive or negative, respectively.
3. PCG, NCG (Positive/negative CV)
The PCG or NCG status is determined by the CV signal value. PCG and NCG indicate whether the target (set) tape speed is positive or negative, respectively.

Block 8 (Capstan servo circuit)

Block 8 is the capstan servo amp circuit and comprises the following:

(1) Phase compensator

The phase compensator functions as the interface for conducting the stabilized CTL phase locking of the capstan motor; this is done by phase-compensating the phase error signal sent from the CTL board.

(2) Capstan servo amplifier

A control voltage corresponding to the currently active mode (e.g., the play mode) must be output to the capstan motor. The function of this circuit is changed according to the active mode by an analog switch that is switched by the PLLC, FVCC, FVDC, CVC, and EXT PHASE* signals output by the I/O block. The signal input to Block 8 (CV, FVC, FVD, EXT PHASE*, or PHASE ERROR) is selected by means of these signals.

*: A control signal used when operating the PCM-3324 in synchronization with external equipment (such as a synchronizer, etc.)

(3) Low pass filter

This low pass filter eliminates noise superimposed on the signal controlling the capstan motor; it is a secondary active low pass filter.

(4) Relay

By outputting or not outputting, this relay regulates the control volume coming from Block 8's other three constituent circuits according to the CC (capstan control) command signal, which turns the capstan servo on and off.

Block 9 (Reel speed limiters; including Block 6)
 Block 9 and Block 6, which form the reel speed limiters, comprise the following:

(1) Speed mode selector

The speed mode selector selects one of the following eleven set speed voltages according to the 4-bit IS signal; the IS signal determines the set speed.

Mnemonic	Control word				Description	Voltage at TP901
	IS3	IS2	IS1	IS0		
STOP	0	0	0	0	RESET	0V
FW1	0	0	0	1	CONNECTED WITH "FW1"	-10~+10V
FWD	0	0	1	0	FOR PLAY (FWD)	0.55V
REW	0	0	1	1	SET-UP VOLTAGE REW	-10V
FF	0	1	0	0	SET-UP VOLTAGE FF	+10V
A SHUTTLE	0	1	0	1	CONNECTED WITH A SHUTTLE	-2.7~+2.7V
D SHUTTLE	0	1	1	0	CONNECTED WITH D SHUTTLE	-2.7~+2.7V
LOC	0	1	1	1	CONNECTED WITH LOC DA	-10~+10V
EXT SPD	1	0	0	0	CONNECTED WITH EXT SPEED	-10~+10V
FSWR	1	0	0	1	REVERSE SLOW WIND	-1.1V
SWF	1	0	1	0	FORWARD SLOW WIND	+1.1V

(2) Reel radius detection low pass filter

'Reel radius' refers to the distance from the center of the reel to the outer periphery of the tape wound onto the S and T reels.

This filter smooths and converts into voltage the duty pulse waves from the TD-CD block (Block D); the duty pulses (two: one for each reel) are proportional to the reel radius. The converted voltage is output to the minimum voltage selector.

(3) Minimum voltage selector

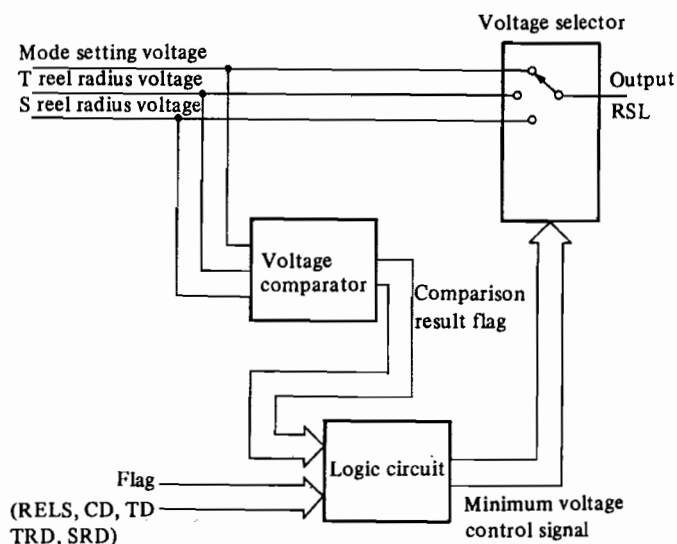
This circuit controls reel speed. It works on the principle that reel speed stabilizes when the reel radius voltage is applied to the capstan servo circuit as the capstan motor speed set voltage; the reel radius voltage is directly proportional to reel radius.

Reel speed on the PCM-3324 is limited to 1200rpm. As the amount of tape wound on a reel increases, so does capstan speed. Capstan speed is mathematically converted into the tape speed, which is kept to about 14m/s.

The hatched area of the following diagram on the next page shows the circuits operating range.

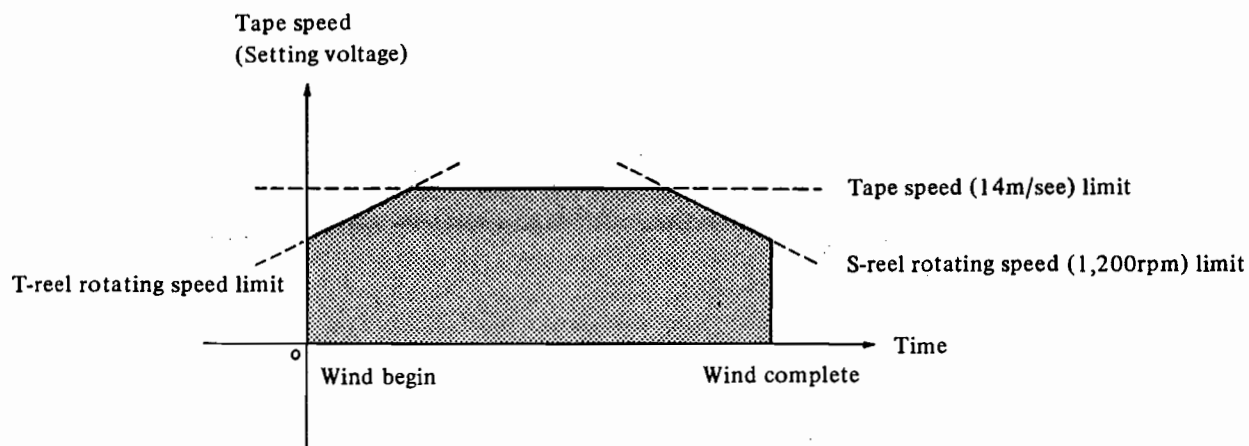
Thus, the range of operation is satisfied by selecting the lowest voltage among the mode set voltage, the T-reel radius voltage, and the S-reel radius voltage; this is performed by the voltage selector block of the circuit.

This circuit comprises a voltage comparator, a logic, and a selector circuit. The voltage comparator compares the mode set voltage, the T-reel radius voltage, and the S-reel radius voltage. The logic circuit receives comparison result flags from the comparator, and tape transport direction flag (TD), capstan motor direction flag (CD), T-reel direction flag (TRD), and S-reel direction flag (SRD). From these, the logic circuit judges which voltage is lowest to control the selector.

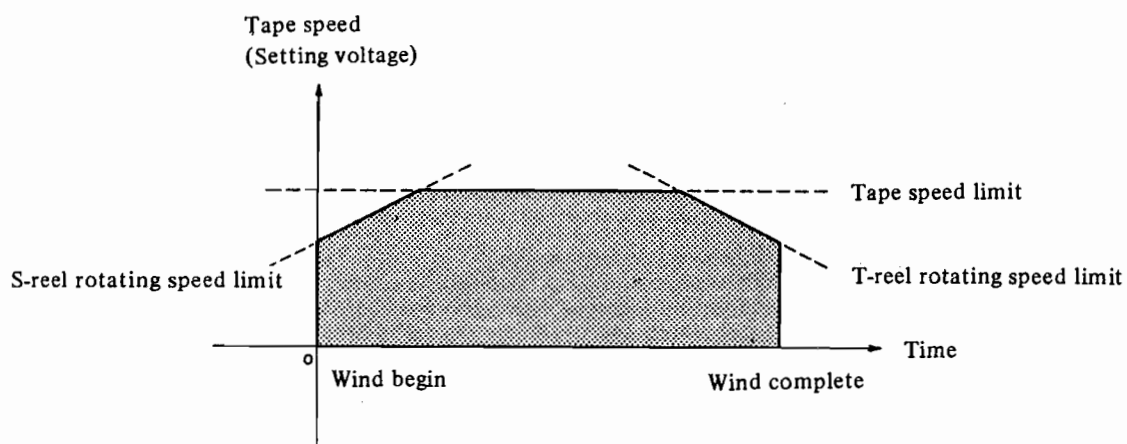


Tape speed control function { Max. reel speed: 1,200rpm
Max. tape speed: 14m/sec

In the FF mode



In the REW mode



(4) Sync offset signal generator

The Sync offset signal generator generates the signal used when operating the PCM-3324 in synchronization with a synchronizer.

Block 0 (I/O unit)

Block 0 comprises the following five blocks:

(1) I/O block (input/output port block)

Information transfers between the SRVO board and the SYS board are conducted through the I/O block. Data communications with the SYS board are effected via three 8-bit data buses.

The I/O block also houses the SHUT OFF signal generator, which applies the electromagnetic brake (C BRAKE) to the capstan; these signals are output to DRV-1.

(2) TD-CD block

The TD-CD block generates the following signals:

CD: Capstan Direction of rotation

TD: Tape Direction of travel

TRD: Take-up Reel Direction of rotation

SRD: Supply Reel Direction of rotation

REL: Signal output when either one of the reel speeds (Tor S) exceeds approx. 800 rpm.

TRR: Duty pulse* proportional to the Take-up Reel Radius.

SRR: Duty pulse* proportional to the Supply Reel Radius.

Duty pulse*: TRR and SRR are signals representing the duty ratio, proportionate to the radius of the tape wound on a reel, generated from the timer roller FG pulse and the reel FG pulse.

(3) PS (power supply) block

The PS block comprises a power supply circuit that outputs the stable +5/-5V power supply for internal use by the SRVO board's circuits, and a detector circuit that monitors whether the +15/-15V power supply is being supplied properly.

(4) DA block (TEN-DA, LOC-DA)

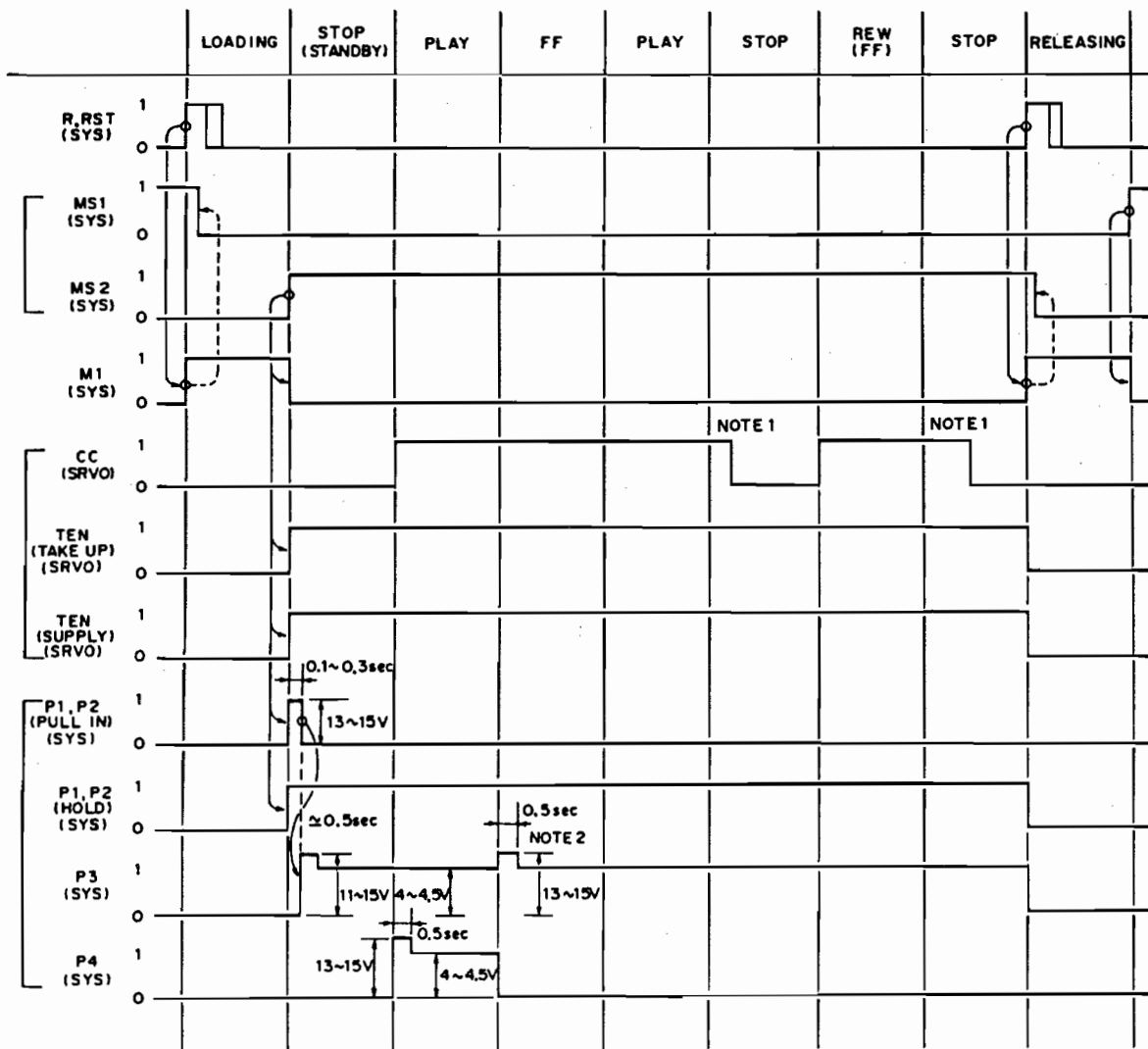
The DA block comprises the TENSION DA D/A converters for compensating tension slip (TEN-DA), and the LOCATOR DA D/A converter for the auto-locator and digital shuttle (LOC-DA).

The TENSION DAs are 8-bit D/A converters controlled by the SYS board CPU. The T-reel tension D/A converter is abbreviated TDAC; the S-reel tension D/A converter, SDAC.

The LOCATOR DA is a 12-bit D/A converter controlled by the LOC board CPU.

(5) INTF block (synchronizer interface)

The INTF block is used in conjunction with the CTL synchronizer interface on the CTL board for CTL synchronization conducted with an external unit such as the RM-3310.



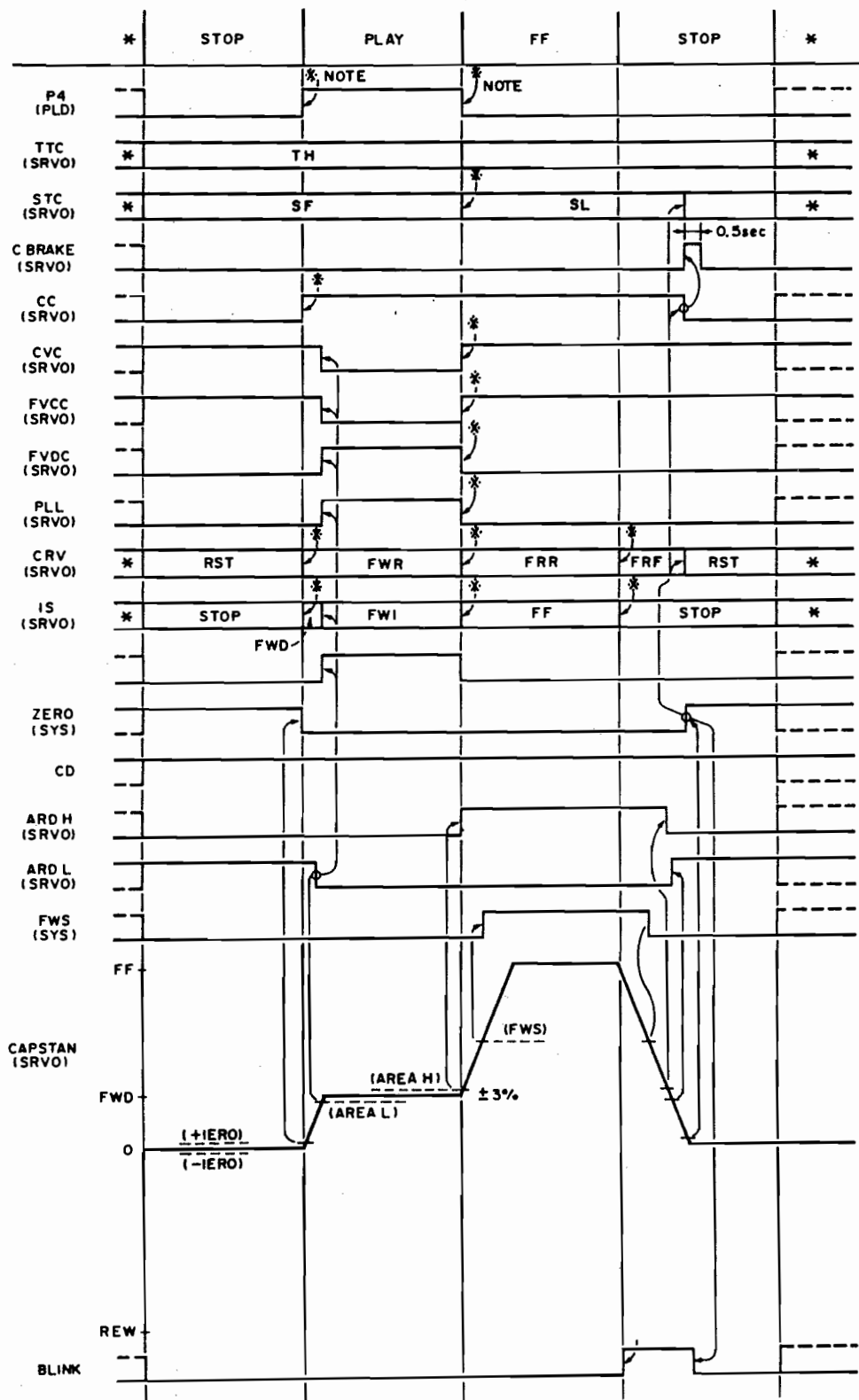
Note 1: CC signal remains ON until the tape comes to a complete stop.

Note 2: Solenoid P3 can be resealed by the shock resulting when solenoid P4 is released.

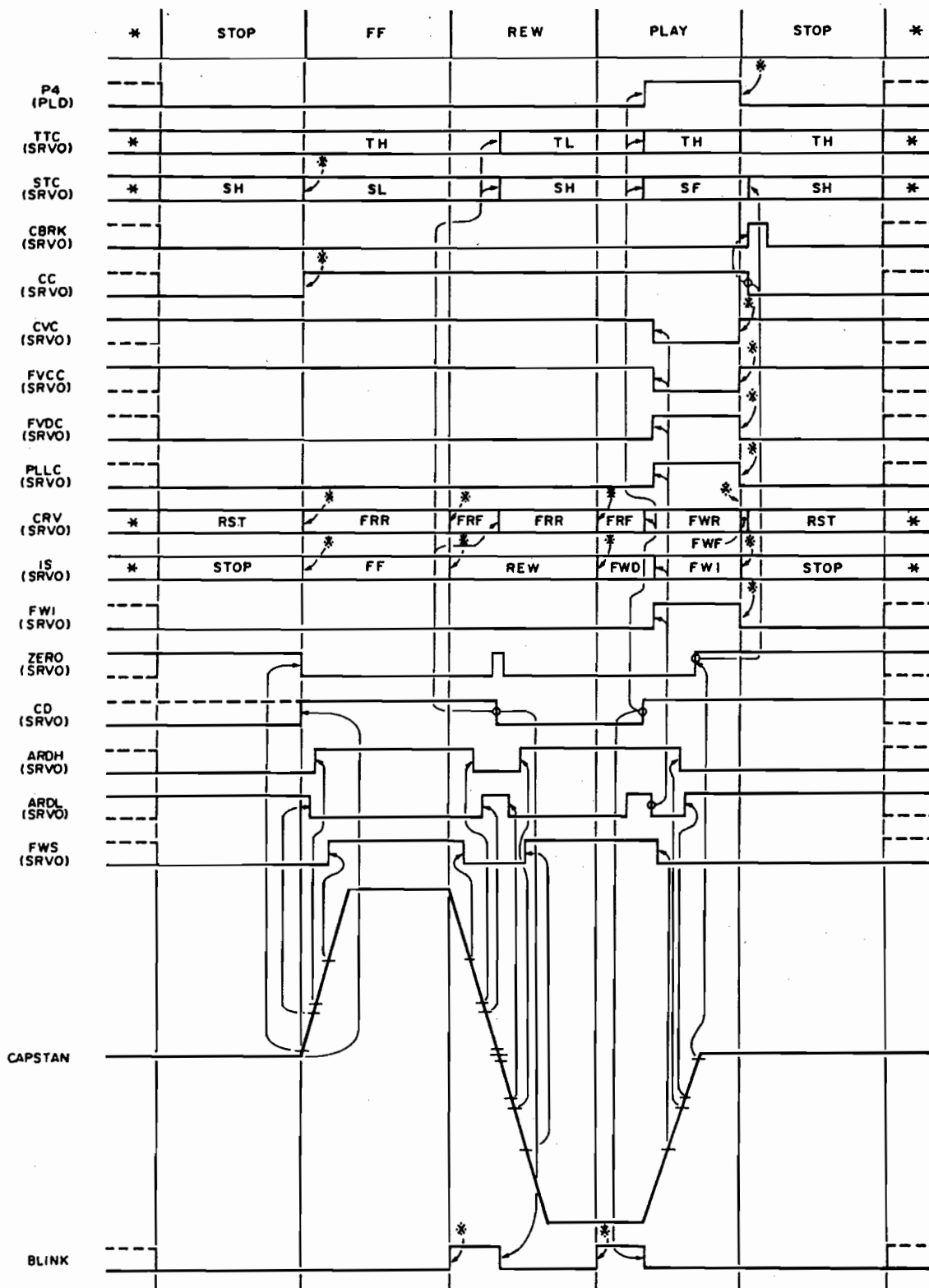
Kick voltage is therefore re-applied to solenoid 3 to prevent this from happening.

Table of signal mnemonics and proper signal names

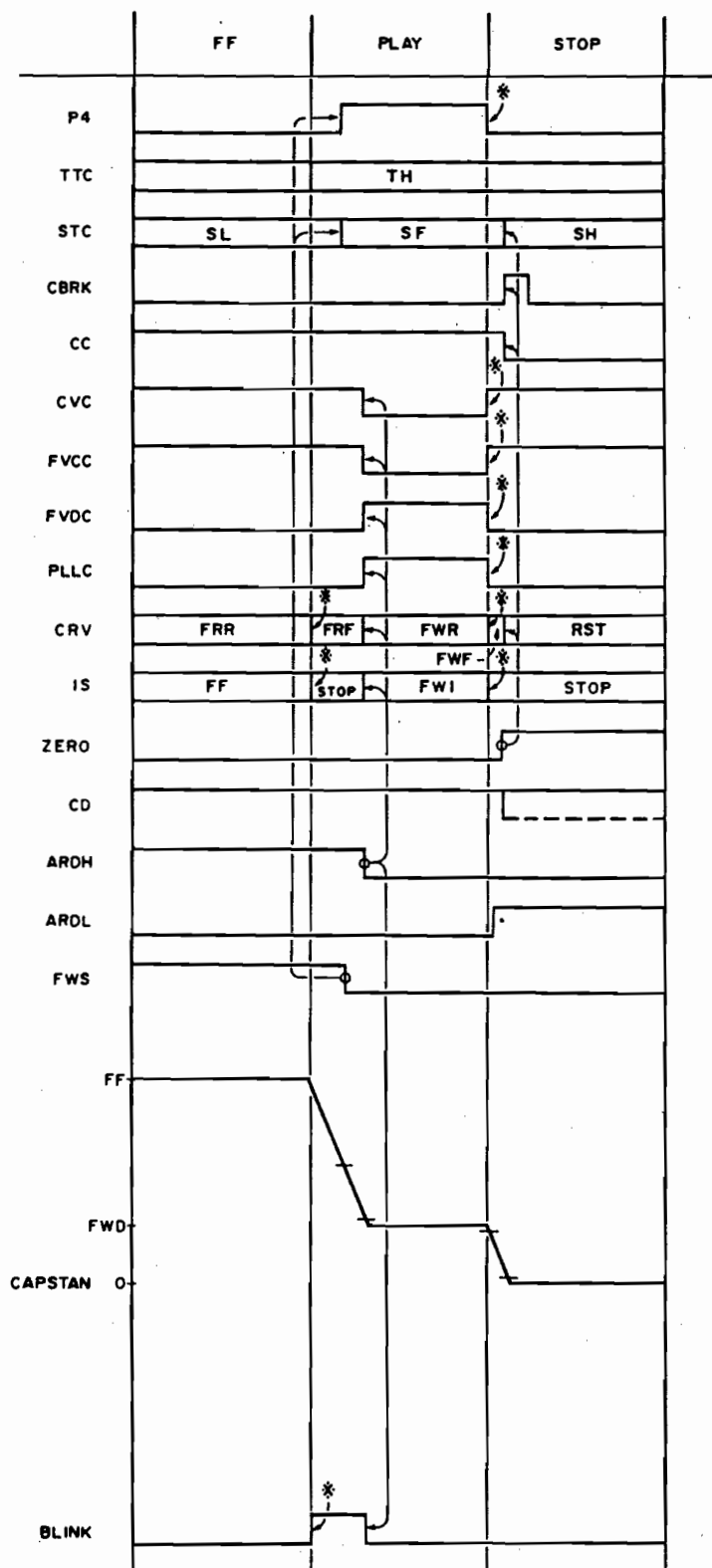
Signal mnemonic	Definition	Signal mnemonic	Definition
ADRS-ZERO	: DIFFERENCE FROM LOCATE ADDRESS IS ZERO	IS	: CAPSTAN SPEED REFERENCE INPUT SELECT
ARDH	: PLAY SPEED AREA DETECTION (HIGH)	LOC-DA OUT	: LOCATE DA CONVERTER OUTPUT VOLTAGE
ARDL	: PLAY SPEED AREA DETECTION (LOW)	M1	: GEARED MOTOR
A-SHUTTLE	: ANALOG SHUTTLE CONTROL	MS1	: GEARED MOTOR POSITION SENSOR (PULL)
BLINK	: FUNCTION LAMP BLINKING	MS2	: GEARED MOTOR POSITION SENSOR (RELEASE)
CAPS	: CAPSTAN SPEED	PLL	: CAPSTAN PHASE LOCK ERROR VOLTAGE
CBRK	: CAPSTAN MOTOR BRAKE	PLLC	: CAPSTAN PHASE LOCK LOOP CONTROL
CC	: CAPSTAN MOTOR CONTROL	P1	: REEL BRAKE SOLENOID (T)
CD	: CAPSTAN ROTATION DIRECTION	P2	: REEL BREAK SOLENOID (S)
CRV	: ACCELERATION CURVE CONTROL	P3	: TAPE LIFTER SOLENOID
CV	: CAPSTAN CONTROL VOLTAGE	P4	: TAPE LIFTER SOLENOID
CVC	: CAPSTAN CONTROL VOLTAGE CONTROL	RRST	: REEL RESET (TENSION DISARM SWITCH)
FVC	: FV CONVERTER OUTPUT VOLTAGE	SHUTTLE	: SHUTTLE VOLTAGE
FVCC	: FV CONVERTER CONTROL	STC	: SUPPLY TENSION CONTROL
FVD	: DIFFERENTIAL FV CONVERTER OUTPUT VOLTAGE	TEN	: TENSION ENABLE CONTROL
FVDC	: DIFFERENTIAL FV CONVERTER CONTROL	TTC	: TAKE UP TENSION CONTROL
FWI	: INVERTED VOLTAGE OF 'FVC' (USED DURING PLAY)	ZERO	: CAPSTAN SPEED IS ZERO
FWS	: PLAY SPEED REFERENCE (X2 PLAY SPEED)		



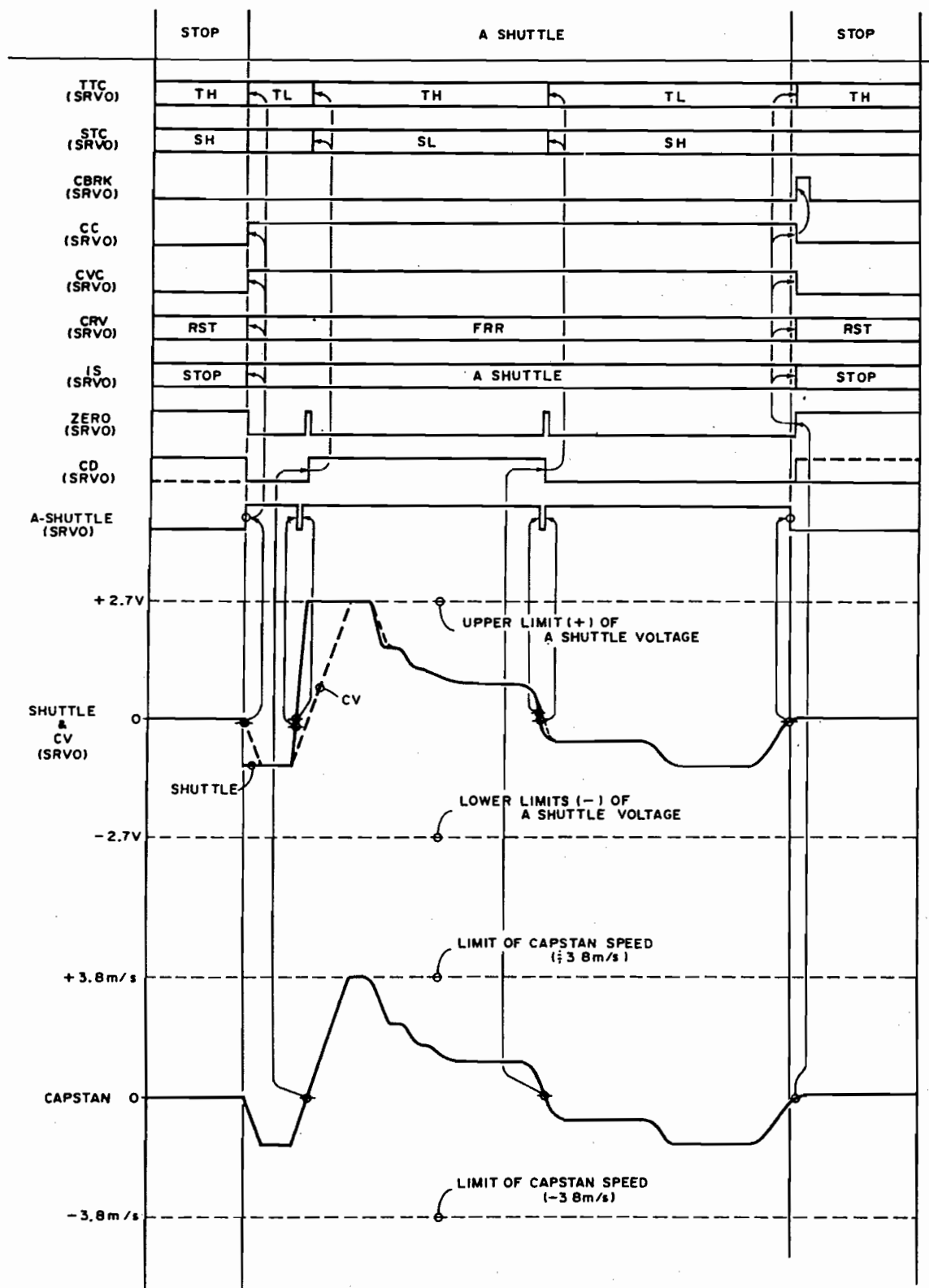
*: These changes occur when the corresponding function keys are pressed.

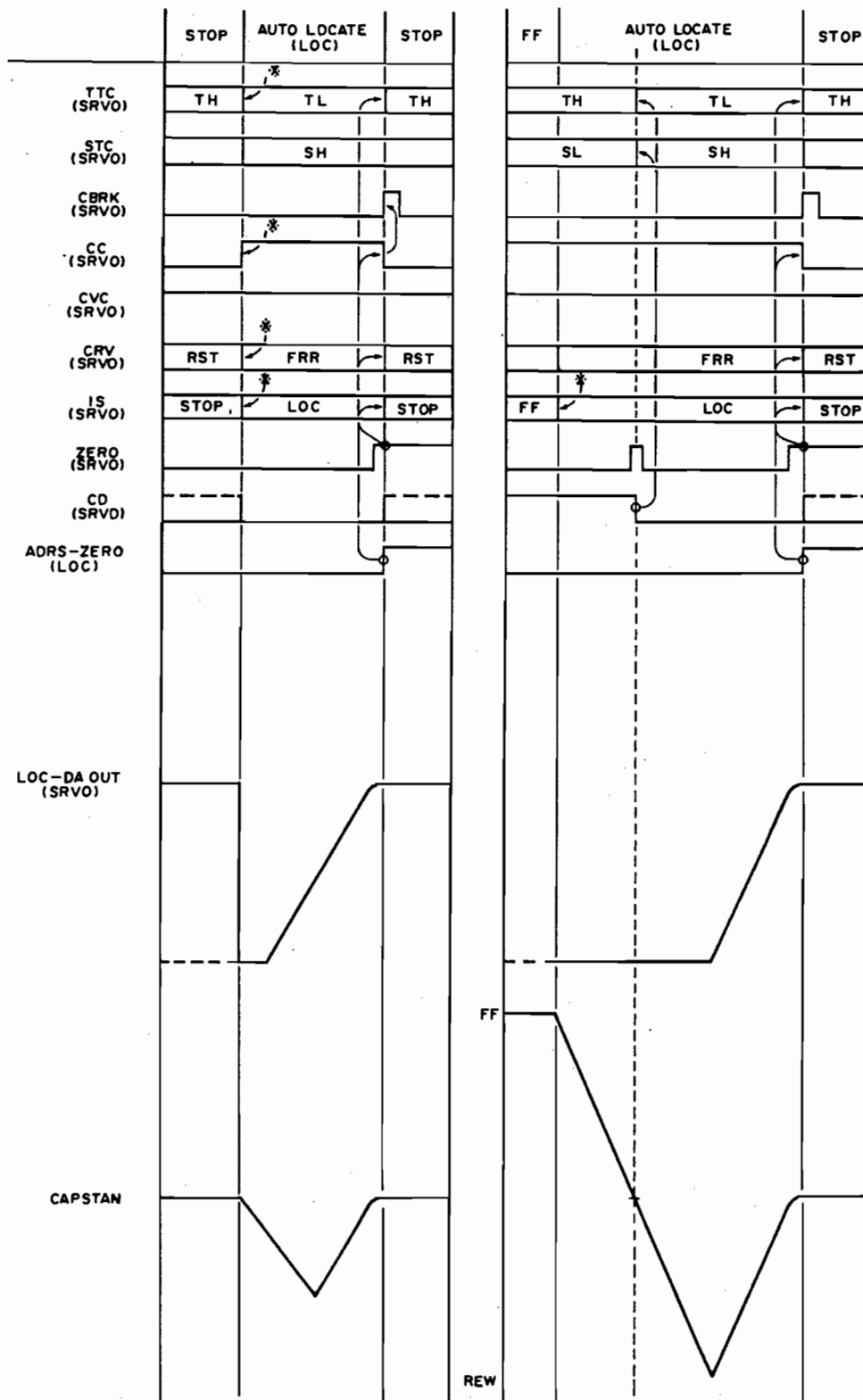


*: These changes occur when the corresponding function keys are pressed.



*: These changes occur when the corresponding function keys are pressed.





*: These changes occur when the corresponding function keys are pressed.

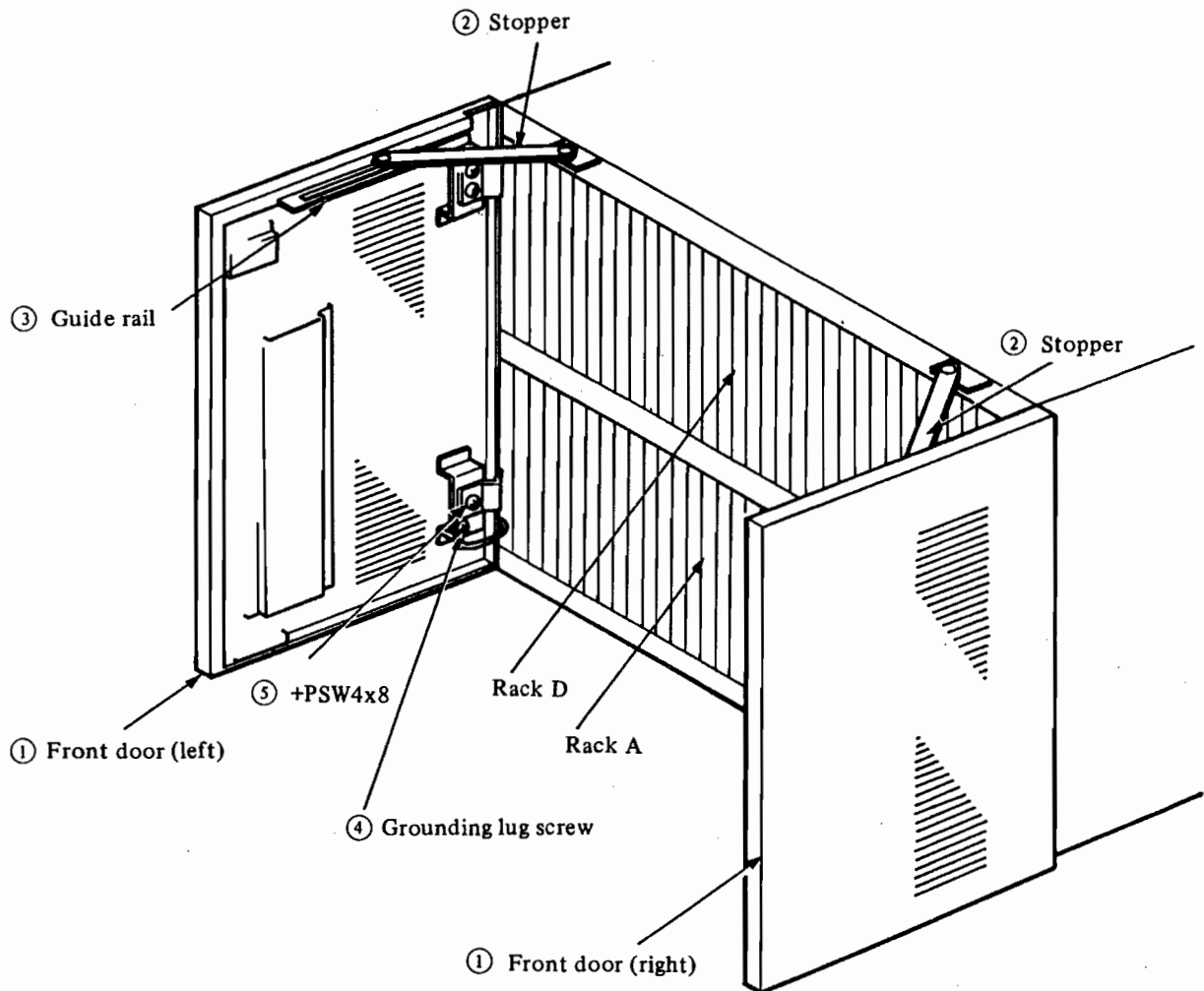
SECTION 3

SERVICE INFORMATION

3.1 General Precautions

3.1.1 Front Doors

The angle of opening of the front doors ① is limited by the stoppers ②. When it becomes necessary to open the doors wider than the stoppers allow—such as when accessing boards near the ends of racks D and A—the stoppers ② can be removed from their guide rails ③ to free the doors. To completely remove a door for better access, unfasten the grounding lug screw ④ and loosen the +PSW 4x8 screw ⑤, then pull the door upward to remove it; both doors can be removed in this manner.



3.1.2 Installing and Disconnecting Boards and

Connectors

Be sure to turn the PCM-3324's power switch off before mounting or dismounting circuit boards and connecting or disconnecting connectors. Not turning the power supply off beforehand can lead to serious damage to the PCM-3324's electrical components.

3.1.3 Cleaning the Heads

Always clean the recording and playback heads in advance of making adjustments on the electromagnetic conversion system (REC board and DET board). Adjustments are likely to be faulty or at least yield unsatisfactory results if conducted without cleaning the heads as the heads may be dirty.

Cleaning equipment

Cleaning leather: part no. 2-034-697-00

Ethyl alcohol

Cleaning procedures

Wet the cleaning leather with the ethyl alcohol, apply it lightly to the surface of the head, and move it horizontally to clean. Be careful not to move the cleaning leather vertically, as doing so can damage the heads.

3.1.4 Tapes for Conducting Inspections and Adjustments

The specialty tapes listed below are necessary for inspecting and adjusting the PCM-3324.

(1) Tape path alignment tape (Sony-made)

For adjusting head-to-tape contact, timer roller level, and head azimuth.

(2) ARP alignment tape 31L120 (made by MRL)

(3) Standard recording blank tape, CID-1/2 (Sony part number 8-873-001-90)

For adjusting the REC and DET boards.

In addition to the reference tapes given above, the normal blank tapes are required for the following adjustments and checks:

(4) For adjusting the tape transport system (tension arms, guide rollers, tape shifters, tape tension, etc.)

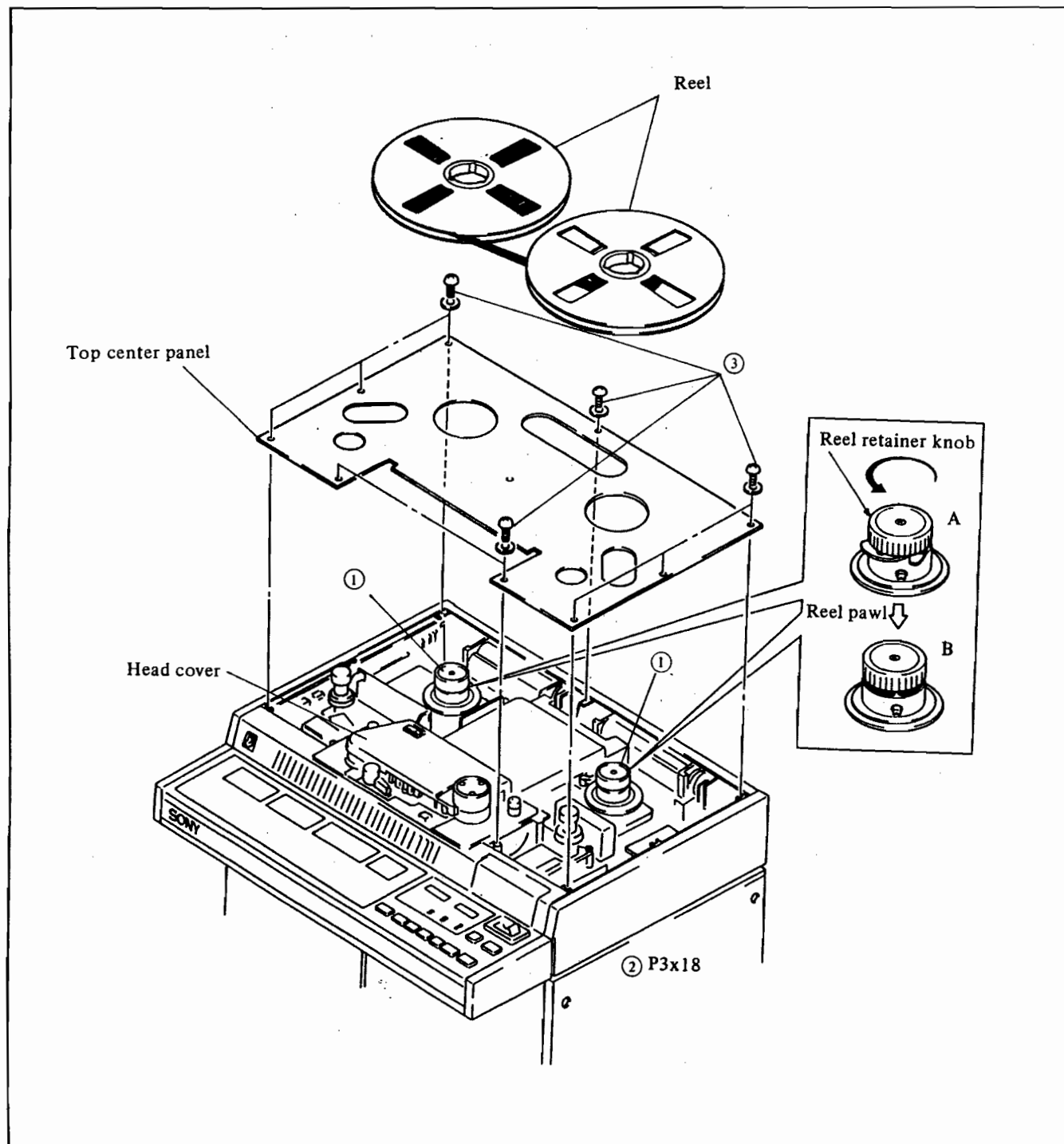
(5) For checking correction performance, CRC error rates, punch in/out function, etc.

We recommend keeping a spare blank tape on hand for adjusting the tape transport system (4) because the surface and edges of the tape can be damaged while adjustments are being made. Furthermore, note that an unused blank tape or tape of equivalent quality must be used for the last check (5).

32 Removing External Fixtures

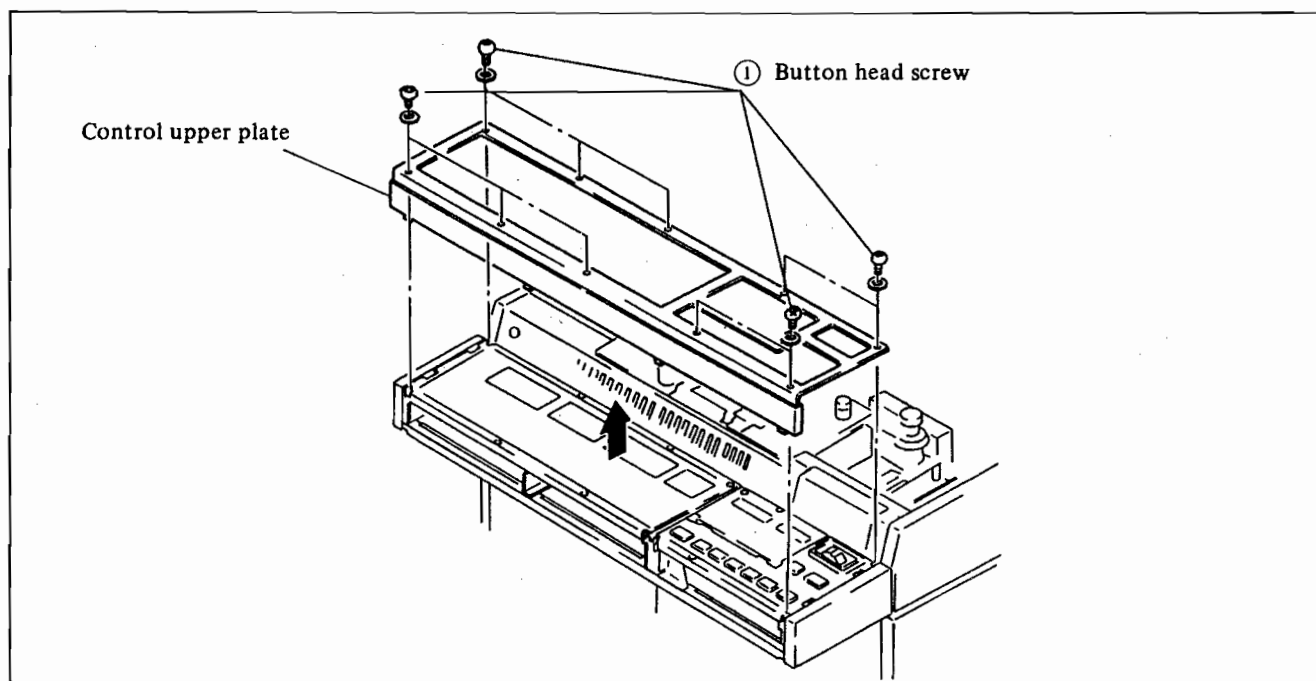
321 Removing of the Upper Center Panel

- ① Turn the reel retainer knob in the direction indicated by the arrow (see diagram A in the figure below) until the reel pawl retracts to the position shown in diagram B, and remove the reel. (See ① in the figure below.)
- ② Loosen the two P3 × 18 screws and remove the head cover. (See ② in the figure below.)
- ③ Unfasten the nine screws and remove the top center panel (required tool: 2.5mm L-shaped hexagonal wrench). (See ③ in the figure below.)

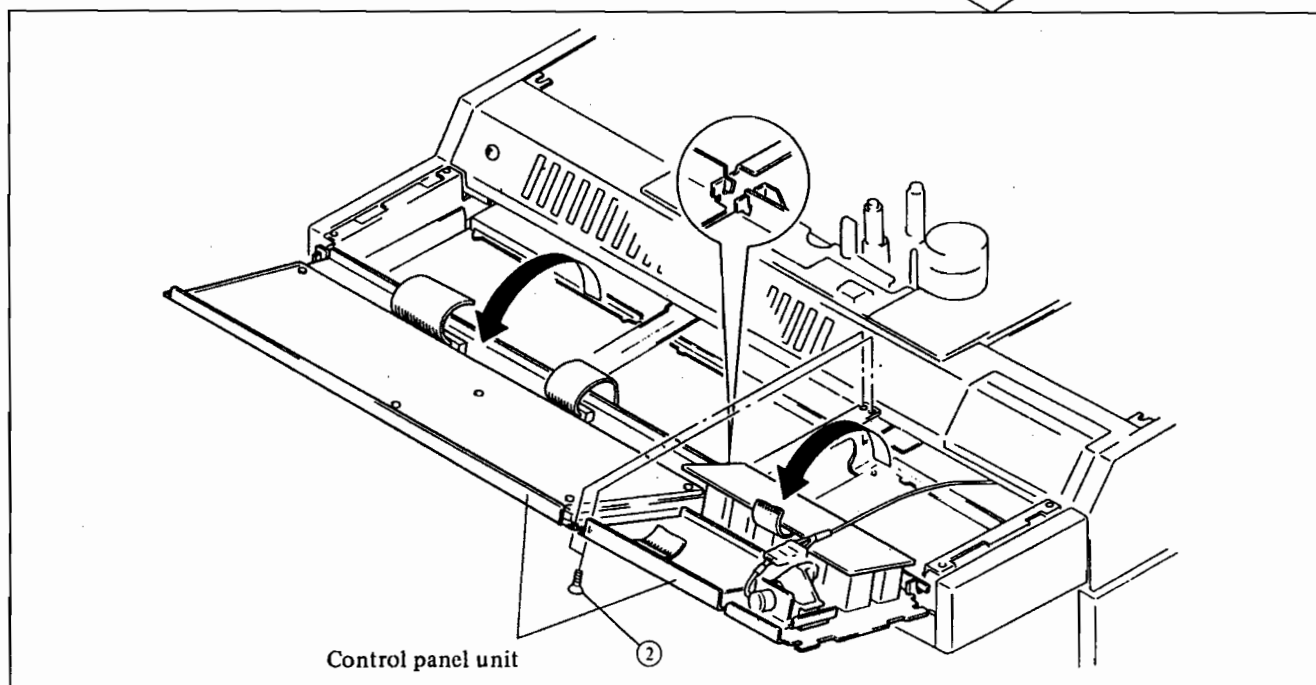


322 Removing the Control Upper Plate and Opening the Control and Meter Panels

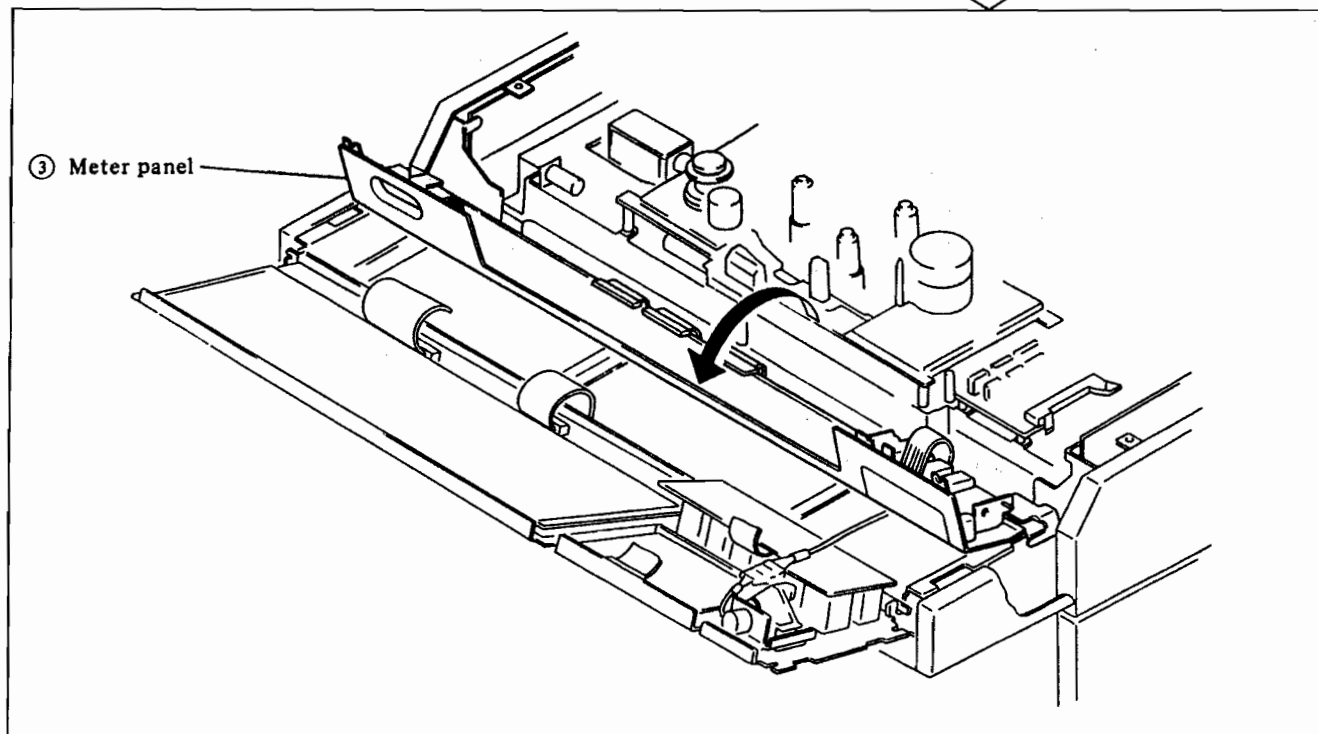
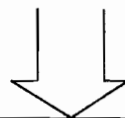
- ① Unfasten the ten screws and remove the control upper plate (required tool: 2.5mm L-shaped hexagonal wrench). (See ① in the figure below.)



- ② Unfasten the two screws and tilt the control panel unit in the direction indicated by the arrows to open it. (See ② in the figure below.)



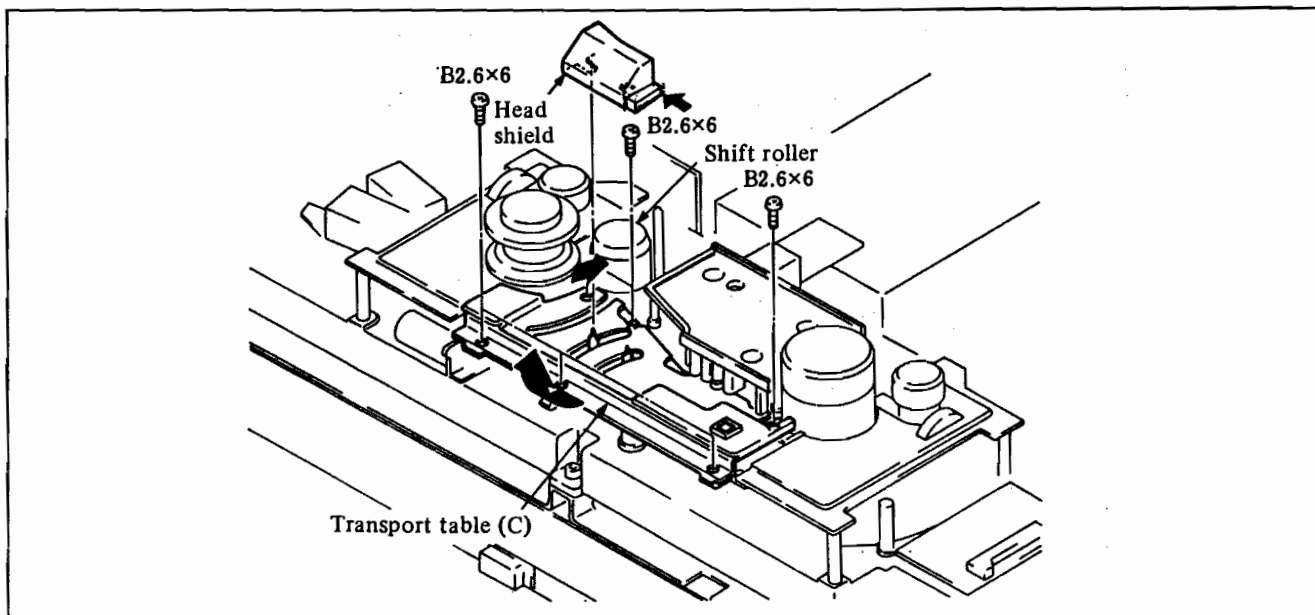
- ③ With the control panel unit opened, open the meter panel by tilting it in the direction indicated by the arrow. (See ③ in the figure below.)



323 Removing the Transport Tables (A), (B), & (C)

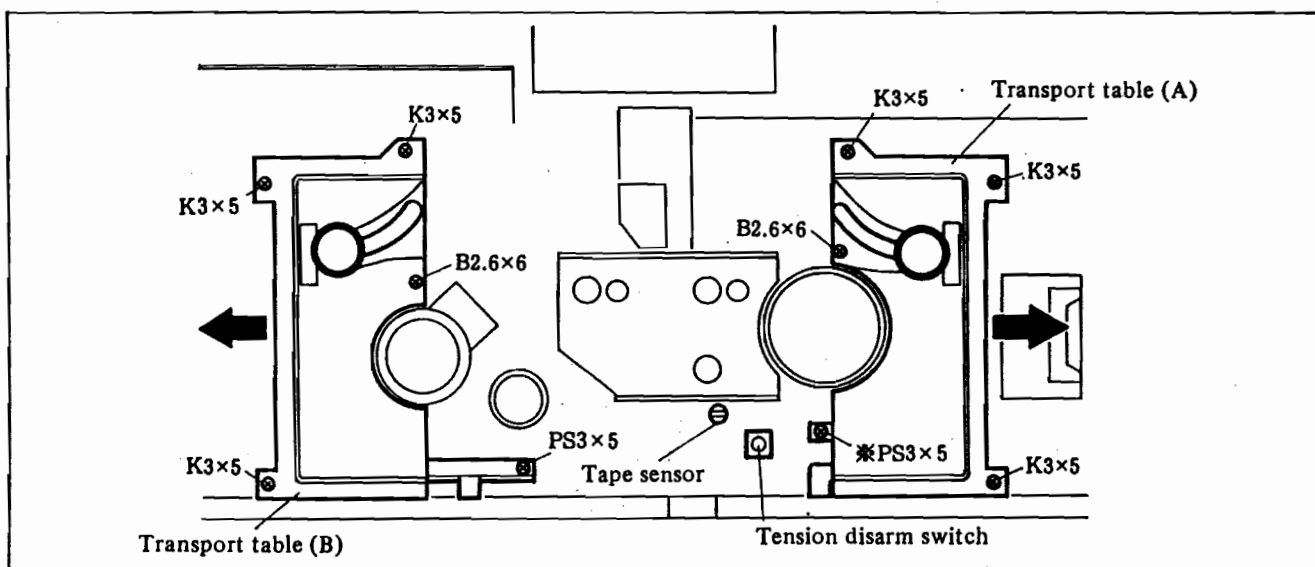
Removal of transport table (C) (See the figure below.)

- ① Remove the head shield by pressing in the direction of the arrows with the fingers.
- ② Unfasten the six screws B2.6x6 securing the transport table (C).
- ③ Press the shift roller in the direction of the arrow and remove the transport table (C) by lifting it upward while pulling forward.



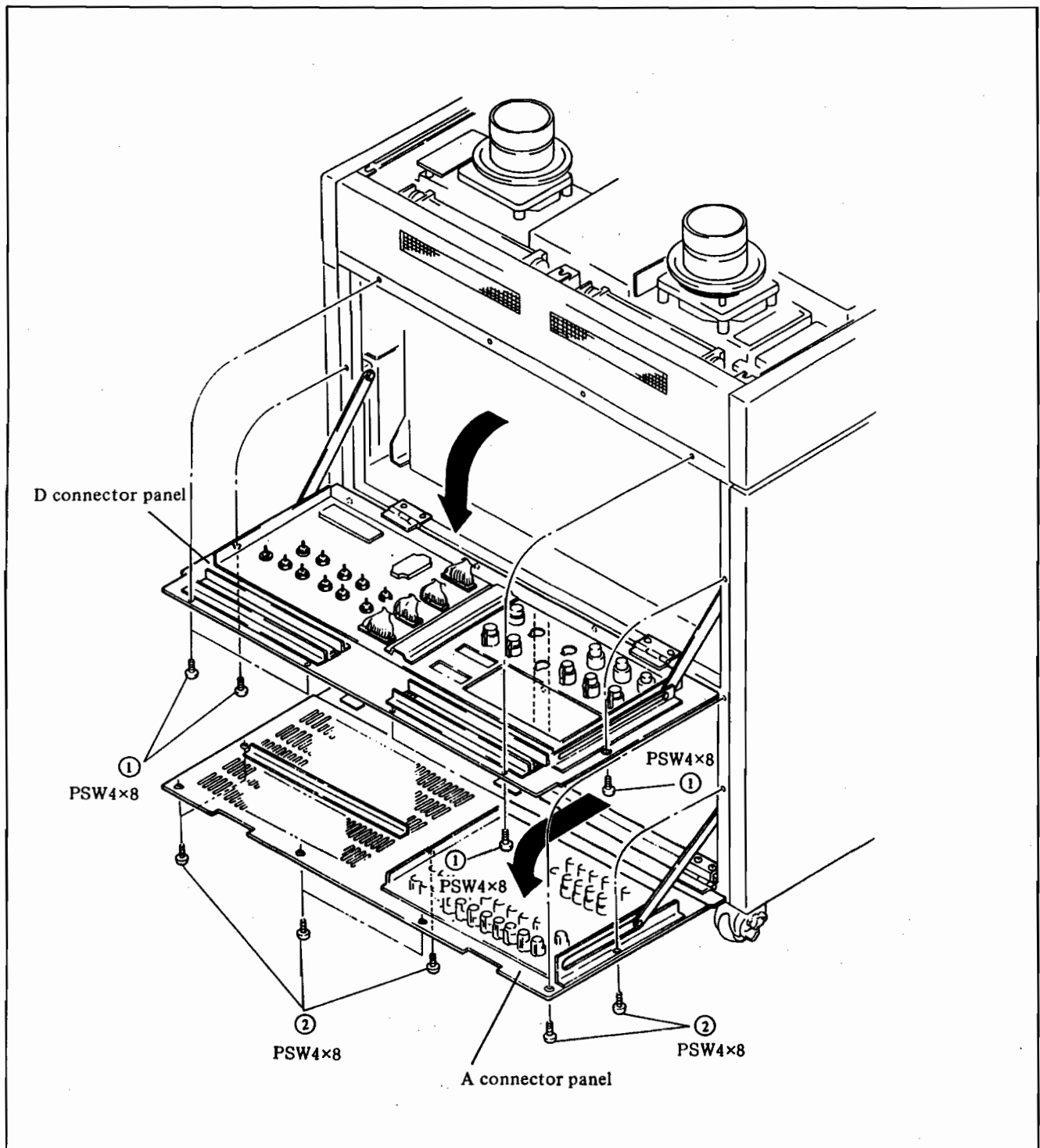
Removal of transport tables (A) and (B) (See the figure below.)

- ① Unfasten the ten screws (PS3 x 5, K3 x 5, and B2.6 x 6).
Note: Use the specific PS3 x 5 screw marked with ※.
- ② Remove transport tables (A) and (B) by pulling them in the directions indicated by the arrows.



3.2.4 Opening Connector Panels A and D (See the figure below.)

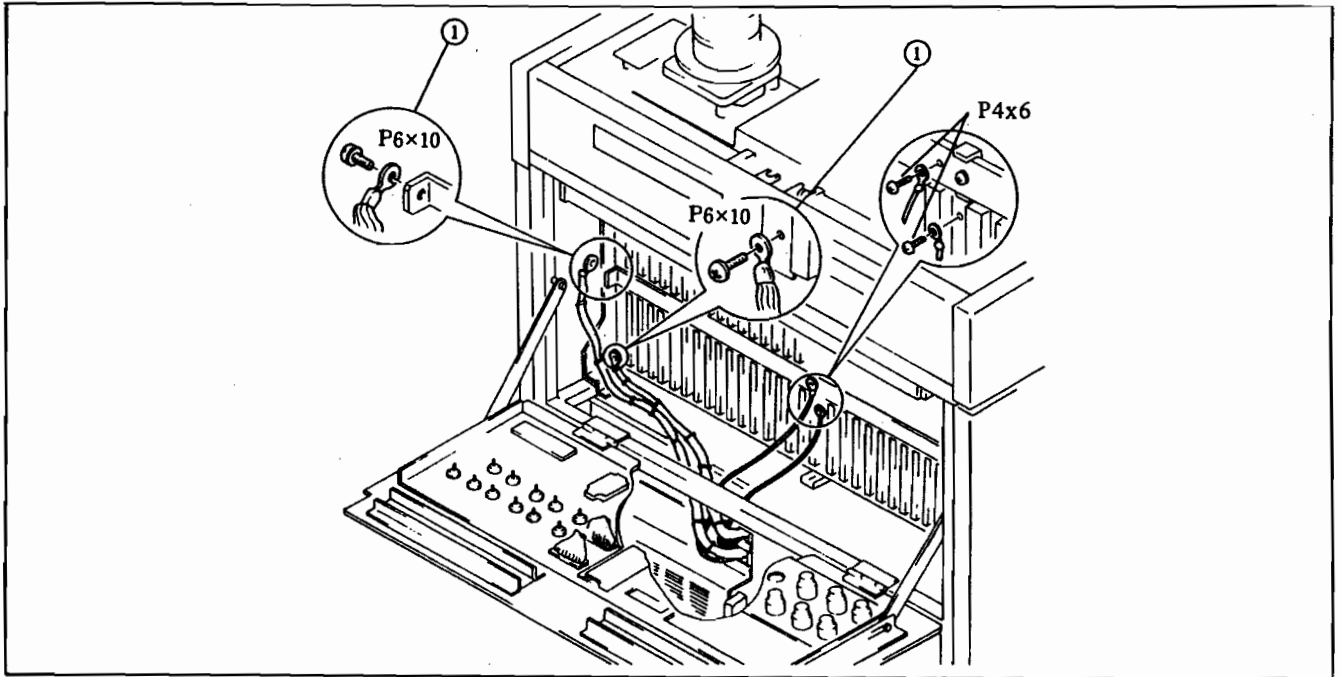
- ① Unfasten the six PSW4 x 8 screws and open connector panel D by tilting it in the direction of the arrow.
- ② Unfasten the seven PSW4 x 8 screws and open connector panel A by tilting it in the direction of the arrow.



3.3 Removing the Power Supply Unit

- ① Unfasten the two P6 × 10 and two P4 × 6 screws, and disconnect the four solderless terminals, two large, and two small ones.

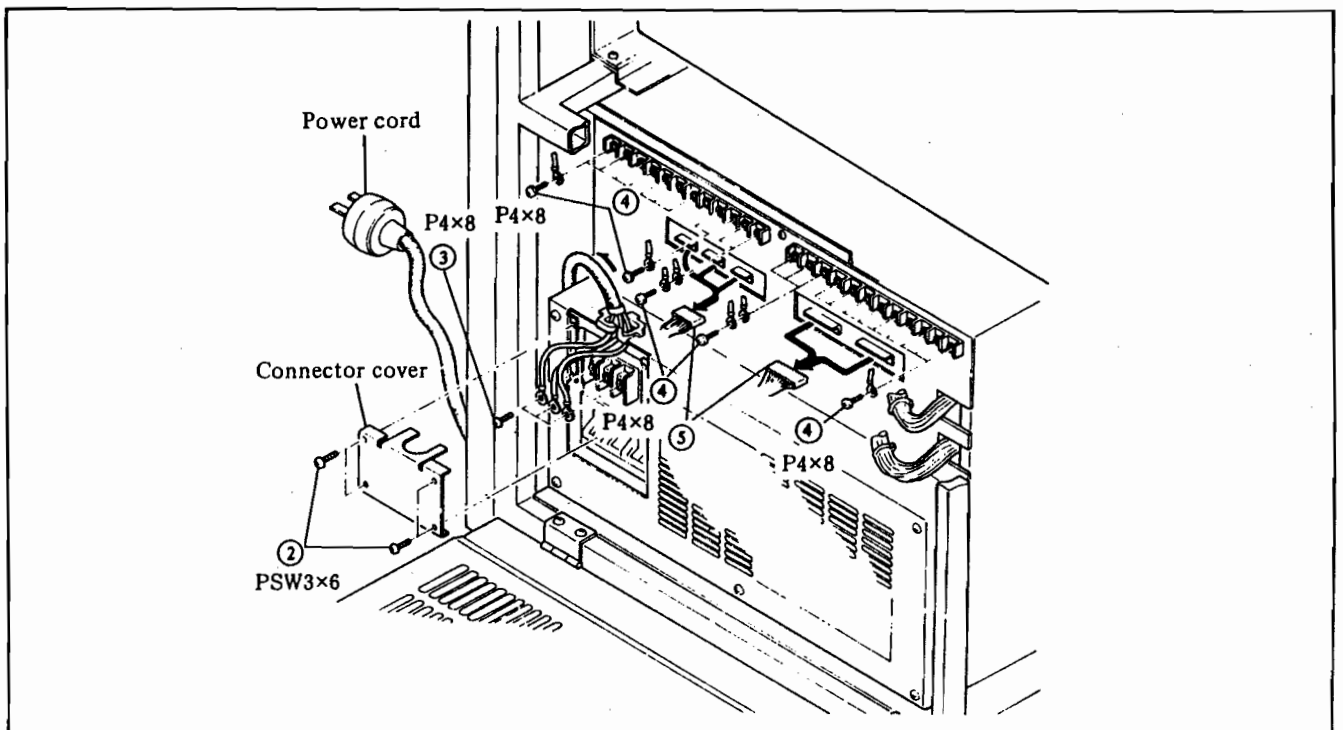
Note: The P6 × 10 and P4 × 6 screws are nickel-plated brass screws.
P6 × 10, part No. 7-682-187-13
P4 × 6, part No. 7-682-160-15



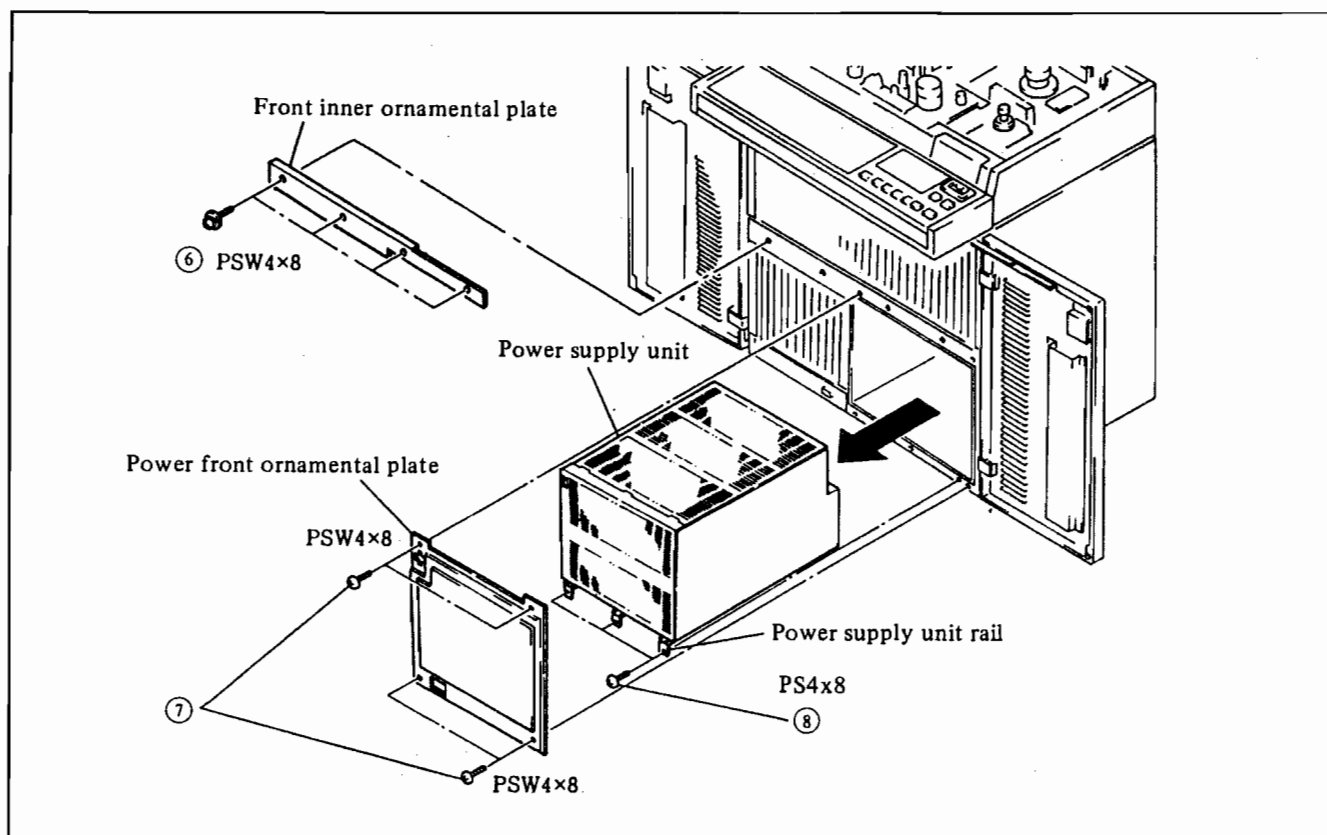
- ② Unfasten the four PSW3 × 6 screws and remove the connector cover.
- ③ Unfasten the three P4 × 8 screws and remove the three solderless terminals, then remove the power cord by pulling it in the direction indicated by the arrow.

- ④ Unfasten the 23 P4 × 8 screws and disconnect the 28 solderless terminals.
- ⑤ Remove the five connectors.

Note: The P4 × 8 screws are nickel-plated brass screws, Sony part no. 7-682-161-13.

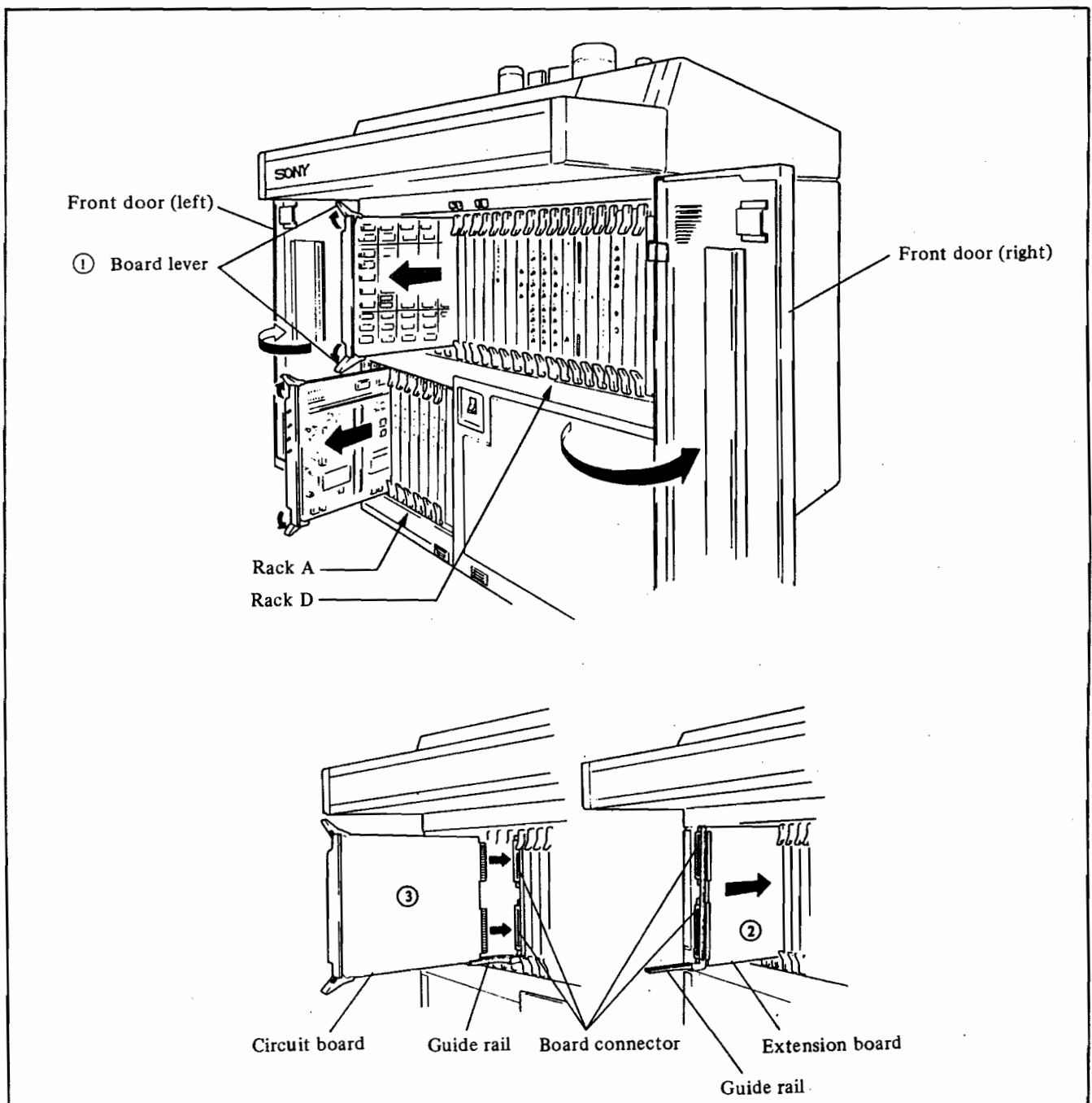


- ⑥ Unfasten the 4 PSW4 x 8 screws and remove the front inner ornamental plate.
- ⑦ Unfasten the 4 PSW4 x 8 screws and remove the power front ornamental plate.
- ⑧ Unfasten the 3 PS4 x 8 screws and remove the power supply unit rail.



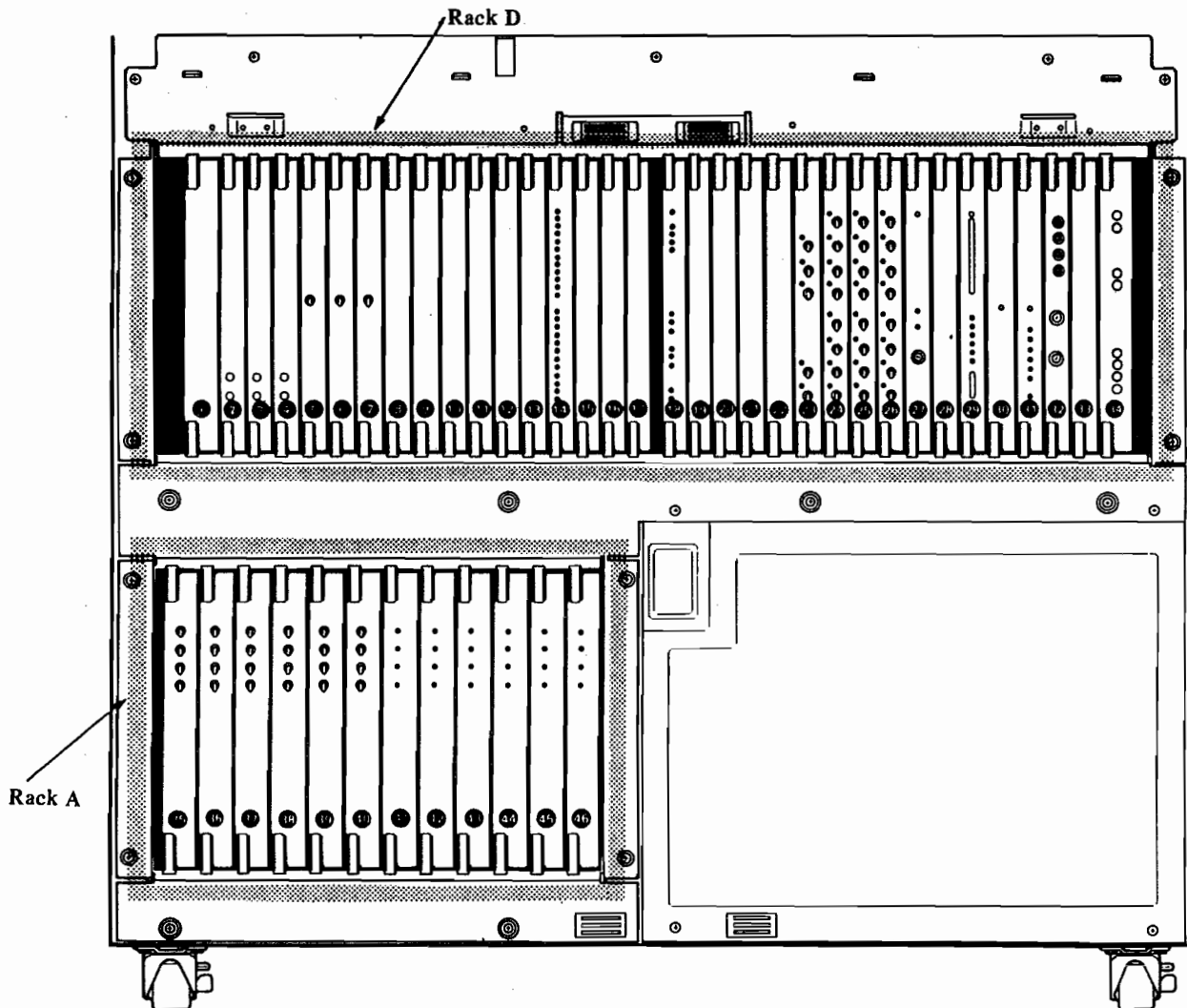
3.4 Using the Extension Board for Adjusting and Checking Circuit Boards

- ① Open the front doors. To remove a circuit board, unfasten the screw at the top and the bottom of the board, open the lever at the top and the bottom of the board, and pull the board out of its slot.
 - ② Insert the extension board in place of the removed board. Note that there are separate extension boards for racks D and A according to the shape of the connectors used on the racks; be sure to use the proper extension board.
 - ③ Slide the circuit board onto the guide and insert its edge connectors into the sockets on the extension board.
- Important!** Be sure to turn the power switch OFF before removing or mounting circuit boards.



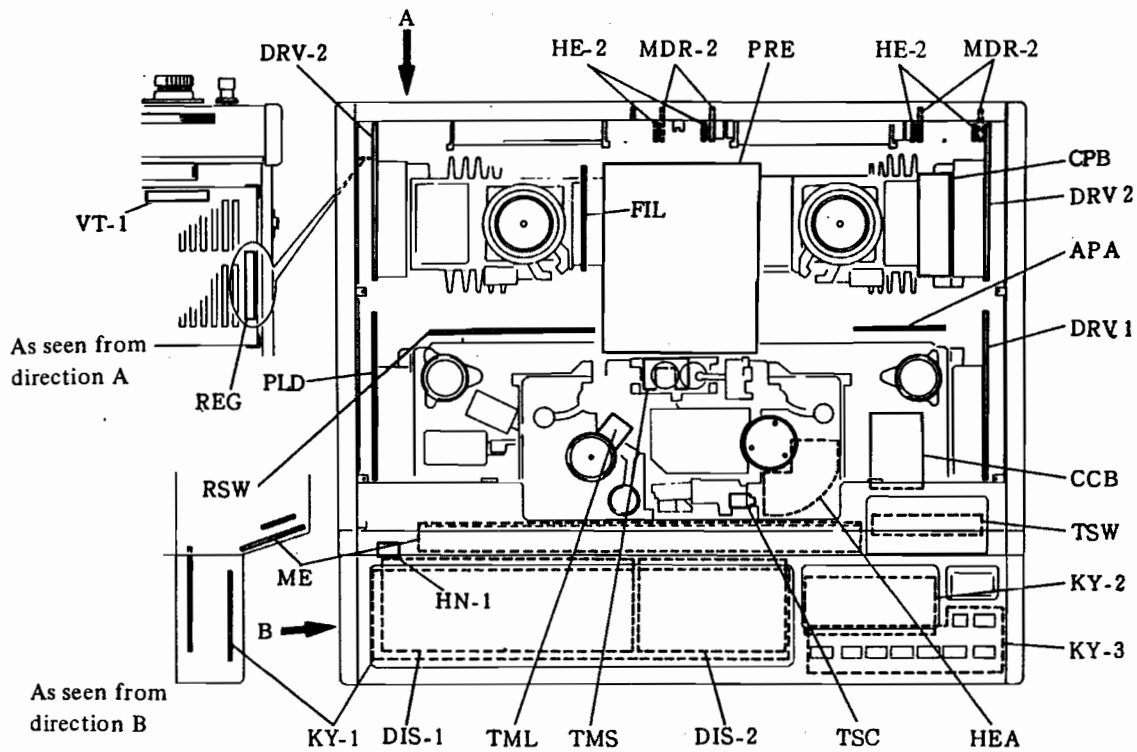
3.5 Arrangement of Circuit Boards

Racks D and A

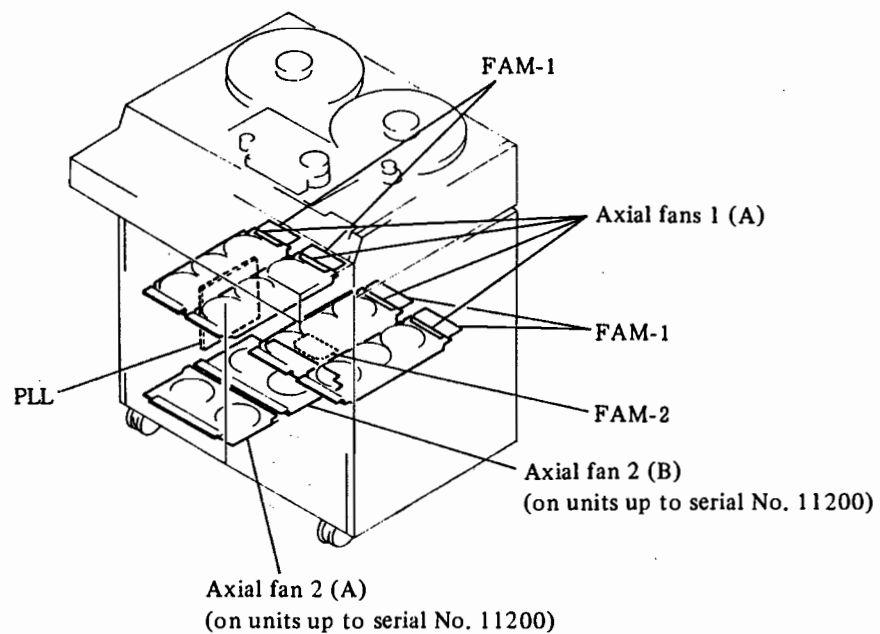


1 REC BOARD	12 SEP BOARD	23 EDTB BOARD	34 ARP BOARD
2 ENC BOARD	13 SEP BOARD	24 DIN-1 BOARD	35 A/D-1 BOARD
3 ENC BOARD	14 TBC BOARD	25 DIN-2 BOARD	36 A/D-2 BOARD
4 ENC BOARD	15 DEC BOARD	26 DIN-3 BOARD	37 A/D-3 BOARD
5 DET-1 BOARD	16 DEC BOARD	27 MCPU BOARD	38 A/D-4 BOARD
6 DET-2 BOARD	17 DEC BOARD	28 EIO BOARD	39 A/D-5 BOARD
7 DET-3 BOARD	18 DCC BOARD	29 CTL BOARD	40 A/D-6 BOARD
8 SEP BOARD	19 Blank panel	30 LOC BOARD	41 D/A-1 BOARD
9 SEP BOARD	20 VCLK BOARD (OPTION)	31 SYS BOARD	42 D/A-2 BOARD
10 SEP BOARD	21 CLK BOARD	32 SRVO BOARD	43 D/A-3 BOARD
11 SEP BOARD	22 EDTA BOARD	33 TCT BOARD	44 D/A-4 BOARD
			45 D/A-5 BOARD
			46 D/A-6 BOARD

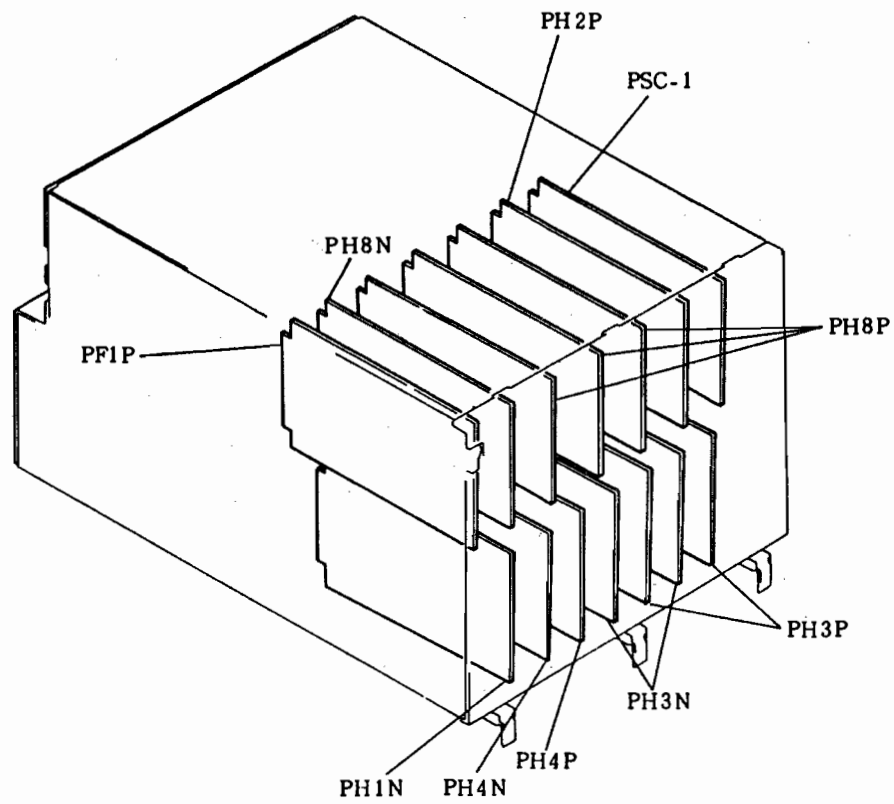
Top view



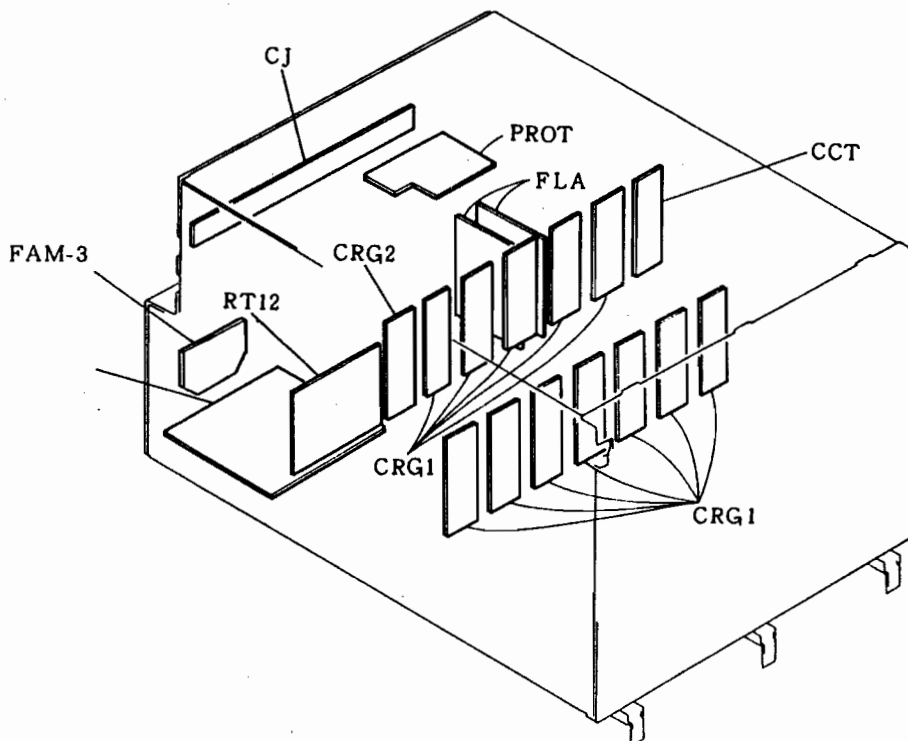
Axial fans



Power supply unit (1)



Power supply unit (2)



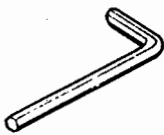
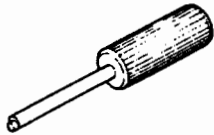
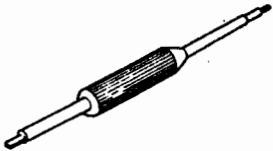
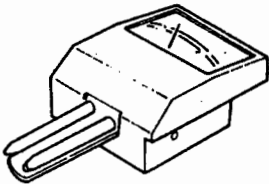
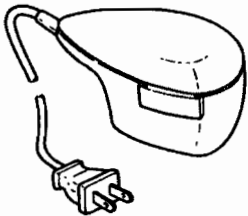
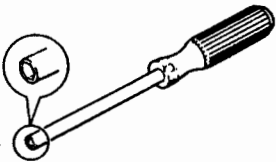
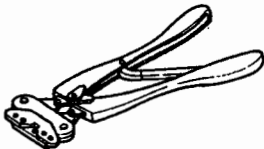
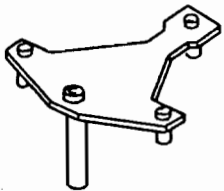
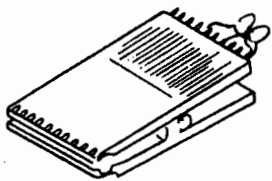
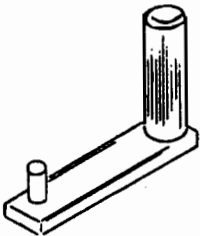
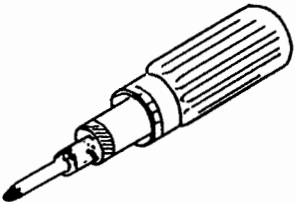
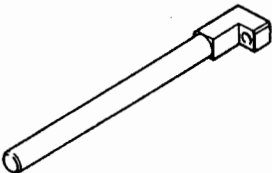
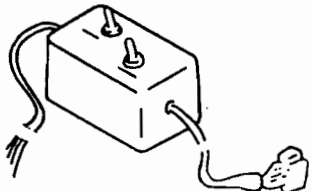
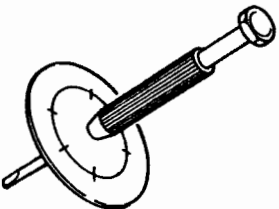
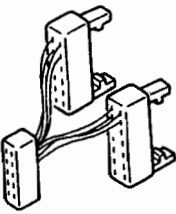
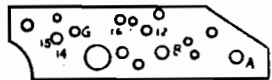
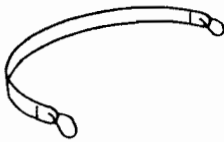
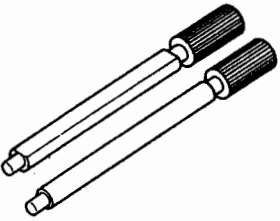
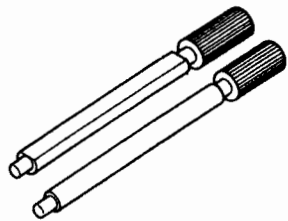
3.6 Service Tools

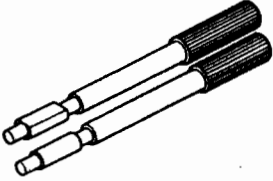
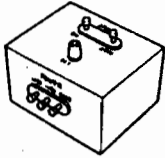
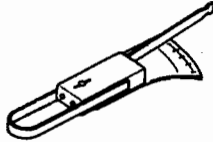
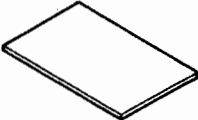
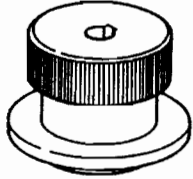
Ref. No.	Name	Part No.	Remarks
J1	Precision screwdriver	7-721-051-10	Blade size: 0.8mm (No. 1), 1.4mm (No. 2), 2.0mm (No. 3) 2.4mm (No. 4), 2.9mm (No. 5), 3.8mm (No. 6)
J2	L-shaped hexagonal wrench	7-700-736-00	Socket size: 1.27mm, 1.4mm, 1.5mm, 1.58mm, 2.0mm, 2.5mm, 3.0mm, 4.0mm, 5.0mm, 6.0mm, 8.0mm, 10.0mm
J3	Eccentric screwdriver	J-610-310-0A	For head spacing adjustment
J4	Alignment tool	7-700-733-02	
J5	Tentelometer	J-6041-680-A	For tape tension adjustment
J6	Head eraser	◎	MODEL QM211 Made by NORTRONICS Inc. (USA)
J7	Nut screwdriver	◎	811262-2
J8	Hand tool	◎	45099
J9	Push-pull tool	◎	305183-J
J10	Tension regulator, Potentiometer adj. jig	J-6103-820-A	For potentiometer position adjustment
J11	Low tension jig (1)	J-6103-840-A	IC test clip for low tension detection
J12	Low tension jig (2)	J-6103-430-A	For low tension detection adjustment
J13	Torque screwdriver	J-6103-860-A	+4mm
J14	Tape shifter bending tool	J-6103-550-A	For tape shifter adjustment (For metal type)
		J-6104-310-A	For tape shifter adjustment (For ceramic type)
J15	Analog REC AMP jig	J-6103-480-A	For analog head adjustment
J16	Dihedral adjusting screwdriver	J-6103-800-A	For head adjustment
J17	Analog extension cable	J-6103-850-A	For analog head adjustment
J18	Screw indication plate	J-6103-630-A	For head adjustment
J19	Azimuth adj. transparent tape	J-6103-540-A	For tentative azimuth and head spacing adjustments

◎ Commercially available in certain areas.
(not available from the Sony Repair Parts Center).

Ref. No.	Name	Part No.	Remarks
J20	Capstan motor positioning pin	J-6103-180-A	φ6.03
J21	Mechanical sub-chassis positioning pin	J-6103-240-A	φ5.3
J22	Roller assy positioning pin	J-6103-230-A	
J23	Filter jig	J-6104-330-A	PC-433
J24	Fan gauge 100g	7-732-050-30	Tension gauge
	Fan gauge 500g	7-732-050-50	Tension gauge
J25	Power supply board checker	J-6103-930-A	
J26	Parallel plate	J-6086-570-A	For head zenith adjustment
J27	Reel brake band guide adjustment jig	J-6103-340-A	
	ARP adjustment reference tape		MRL, 31L120 Fluxivity standard: 200nWb/m
	Cleaning leather	2-034-697-00	
	ENC jig	J-6220-200-A	
	SONY grease	7-662-001-62	SGL-501
	Oil	7-661-018-01	Mitsubishi diamond oil Hydro fluid EP-56
	Standard recording blank tape	8-873-001-90	C1D-1/2
	Tape path alignment tape (timer roller height, digital head azimuth, analog head azimuth, tape-to-head contact)	8-960-080-01	

Figures corresponding to the above reference numbers are carried on the following pages; please use them as a reference.

J1 	J2 	J3 
J4 	J5 	J6 
J7 	J8 	J9 
J10 	J11 	J12 
J13 	J14 	J15 
J16 	J17 	J18 
J19 	J20 	J21 

J22 	J23 	J24 
J25 	J26 	J27 

SECTION 4

PERIODIC INSPECTIONS AND MAINTENANCE

4.1 Purpose of Periodic Inspections

The purpose of the periodic inspections described in this section is to prevent malfunctions and breakdowns resulting from wear and material fatigue, which advance in proportion to frequency and accumulated time of use, in the PCM-3324's mechanical and drive systems.

In systems like the PCM-3324 that include digital processing systems, and especially those protected by error correction codes, minute defects in system components do not become readily apparent, and their detection is consequently often delayed (see the Figure below.) The periodic inspections recommended in this section are designed to eliminate this vulnerability in the PCM-3324 by aggressively discovering and repairing potential defects before they occur.

The basic purpose of performing these periodic inspections and maintenance procedures is to maintain the electrical and mechanical standards listed in the PCM-3324's operation manual.

4.2 Methodology of Periodic Inspections and Maintenance Procedures

In order to achieve the objectives stated above, the periodic inspections and maintenance procedures entail the following: replacing worn parts, cleaning components of the mechanical systems, lubricating, and conducting accompanying inspections and adjustments of the mechanical and electrical systems. These procedures are to be conducted at regular intervals according to the reading of the head operation meters located on the rear panel of the PCM-3324. The intervals for each inspection and maintenance procedure and part replacement are given in Table 4-1.

Note that the part-replacement intervals given in the table have been established on the basis of part life as estimated from actual performance. Sony therefore reserves the right to revise these intervals as it sees fit according to newly obtained part-life data.

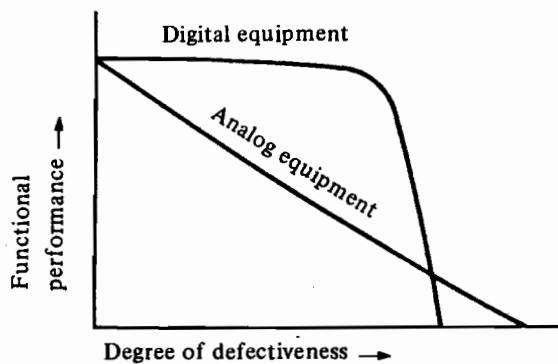


Table 4-1. PCM-3324 Periodic Inspection and Maintenance Schedule (guidelines)

Definition of symbols:

☆Replace part ◇Inspect and adjust

Conduct periodic inspections and maintenance procedures (including part replacement) according to the following schedule. Inspection and maintenance work should be carried out first after 2,500H. After the first 18,000H inspection & maintenance, repeat the schedule every 4,500 hours from the 4,500H inspection and maintenance program.

		H = hours					
Inspection & maintenance item	(Index No.)	Q'ty	2500H	4500H	9000H	13500H	18000H
1. Tape transport system							
1) HBU internal tape guide G1 tape-travel check			◇	◇	◇	◇	◇
2) Tape guide G2 tape-travel check			◇	◇	◇	◇	◇
3) Tape guide G3 tape-travel check			◇	◇	◇	◇	◇
4) Tape guide G4 tape-travel check			◇	◇	◇	◇	◇
5) Shifter arm tape-travel check			◇	◇	◇	◇	◇
6) Tape curl			◇	◇	◇	◇	◇
2. Timer roller section							
1) Timer roller ass'y (A-7810-058-A)	5-6-1	1			☆		☆
2) Bearing (4-888-483-01)	5-6-2	2	◇	☆	◇	☆	◇
3) Abnormal noise from rotating parts			◇	◇	◇	◇	◇
4) Timer roller height	5-3-2		◇	◇	◇	◇	◇
3. Guide roller section							
1) Guide roller ass'y (A-7810-057-A)	5-8-1	2			☆		☆
2) Bearing (4-888-483-01)	5-8-2	2	◇	☆	◇	☆	◇
3) Abnormal noise from rotating parts			◇	◇	◇	◇	◇
4) Tape travel	5-3-4		◇	◇	◇	◇	◇
4. Tension roller section							
1) Tension arm (S) ass'y (A-7810-130-B)	5-7-1	1			☆		☆
2) Tension arm (T) ass'y (A-7810-132-B)	5-7-1	1			☆		☆
3) Abnormal noise from rotating parts			◇	◇	◇	◇	◇
4) Bearing (4-888-483-01)		4	◇	☆	◇	☆	◇
5) Tape travel	5-3-3						
5. Shifter section							
1) Shift roller ass'y (A-7810-056-A)	5-4-6	1			☆		☆
2) Shift roller (4-882-464-03)	5-4-7	1		☆	◇	☆	◇
3) Bearing (4-888-483-01)	5-4-7	2	◇	☆	◇	☆	◇
4) Abnormal noise from rotating parts			◇	◇	◇	◇	◇
5) Tape travel	5-3-8		◇	◇	◇	◇	◇
6) Tape shifter arm ass'y (X-4882-430-3)	5-5-1	1		◇	☆	◇	☆

Inspection & maintenance item	(Index No.)	Q'ty	2500H	4500H	9000H	13500H	18000H
6. Reel table sections							
1) Reel motor (S) ass'y (A-7810-061-A)	5-9	1			☆		☆
2) Reel motor (T) ass'y (A-7810-063-A)	5-9	1			☆		☆
3) Brake mechanism	5-10		◇	◇	◇	◇	◇
4) Brake torque	5-10		◇	◇	◇	◇	◇
5) Reel table height	5-3-7		◇	◇	◇	◇	◇
6) Abnormal noise from rotating parts			◇	◇	◇	◇	◇
7. Capstan motor section							
1) Capstan motor ass'y (A-7810-131-A)	5-11	1			☆		☆
2) Abnormal noise from rotating parts			◇	◇	◇	◇	◇
8. HBU (Head Block Unit)							
1) HBU ass'y (RKA3324-E)	5-12	1	◇	☆	☆	☆	☆
2) D/ADV REC head azimuth	5-12-9			◇	◇	◇	◇
3) D/SYNC REC head azimuth	5-12-9			◇	◇	◇	◇
4) D/PB head azimuth	5-12-9			◇	◇	◇	◇
5) A/RP head azimuth	5-12-9			◇	◇	◇	◇
6) A/E head azimuth	5-12-9			◇	◇	◇	◇
7) D/ADV REC head-to-tape contact	5-12-10			◇	◇	◇	◇
8) D/SYNC REC head-to-tape contact	5-12-10			◇	◇	◇	◇
9) D/PB head-to-tape contact	5-12-10			◇	◇	◇	◇
10) A/RP head-to-tape contact	5-12-10			◇	◇	◇	◇
11) A/E head-to-tape contact	5-12-10			◇	◇	◇	◇
12) Head spacing: D/ADV REC-D/PB	5-12-11			◇	◇	◇	◇
13) Head spacing: D/PB-D/SYNC REC	5-12-11			◇	◇	◇	◇
14) D/ADV REC head height	5-12-12			◇	◇	◇	◇
15) D/SYNC REC head height	5-12-12			◇	◇	◇	◇
16) D/PB head height	5-12-12			◇	◇	◇	◇
17) A/RP head height	5-12-12			◇	◇	◇	◇
18) A/E head height	5-12-12			◇	◇	◇	◇
9. System control block/others							
1) FF/REW speed	6-2-3		◇	◇	◇	◇	◇
2) Slow wind speed	6-2-1		◇	◇	◇	◇	◇
3) CTL lock	6-2-2		◇	◇	◇	◇	◇
4) Capstan wow	6-1-1		◇	◇	◇	◇	◇
5) S/T-reel tension arm detection position	5-7-3		◇	◇	◇	◇	◇
6) REW tension SH	5-7-3		◇	◇	◇	◇	◇
7) REW tension TL	5-7-3		◇	◇	◇	◇	◇

Inspection & maintenance item	(Index No.)	Q'ty	2500H	4500H	9000H	13500H	18000H
8) FF tension TH	5-7-3		◇	◇	◇	◇	◇
9) FF tension SL	5-7-3		◇	◇	◇	◇	◇
10) Play tension SF	5-7-3		◇	◇	◇	◇	◇
11) Slip servo	5-7-4		◇	◇	◇	◇	◇
12) Plunger solenoid (B) (1-454-322-00)	5-7-4	1	◇	◇	☆	◇	☆
13) Plunger solenoid (A) (1-454-323-00)	5-4-2	1	◇	◇	☆	◇	☆
14) Shifter roller control (air damper)	5-4-2		◇	◇	◇	◇	◇
15) Axial fan ass'y (A-7810-102-C)	5-13-2	16	◇	☆	☆	☆	☆
16) WOW	6-3		◇	◇	◇	◇	◇
17) Cross-flow fan (A) ass'y (A-7810-036-A)	5-13-1	2	◇	☆	☆	☆	☆
18) Cross-flow fan (B) ass'y (A-7810-039-A)	5-13-1	2	◇	☆	☆	☆	☆
19) Geared motor ass'y (A-7810-047-A)	5-1-1	1			☆		☆
20) Reed switch (1-553-117-21)	5-1-2	2		☆	☆	☆	☆
21) Power switch (1-516-379-00)		1			☆		☆
22) RSW board relay (1-515-660-11)		13		☆	☆	☆	☆
10. Electrical adjustments							
1) Power supply voltage check			◇	◇	◇	◇	◇
2) ARP board adjustments (Analog system)	6-4			◇	◇	◇	◇
3) REC current (Digital system)	6-6-1			◇	◇	◇	◇
4) REC current offset				◇	◇	◇	◇
5) Playback equalizer adjustments	6-6-2			◇	◇	◇	◇
6) CTL record current	6-6-1, 6-6-3			◇	◇	◇	◇
7) TCT board adjustments	6-5			◇	◇	◇	◇
8) A/D offset	6-7-5		◇	◇	◇	◇	◇
11. Electrical characteristics							
1) Noise ratio measurements	6-7-7		◇	◇	◇	◇	◇
2) Frequency measurements	6-7-8		◇	◇	◇	◇	◇
3) Distortion measurements	6-7-9		◇	◇	◇	◇	◇
12. Function checks							
1) Punch in/Punch out			◇	◇	◇	◇	◇
2) Function control performance			◇	◇	◇	◇	◇
3) Shuttle function			◇	◇	◇	◇	◇

Note: The replacement intervals for parts marked with an asterisk(*) to the right of the table, vary according to operating conditions.

SECTION 5

REPLACEMENT AND ADJUSTMENT OF MECHANICAL COMPONENTS

5.1 Replacing the Tape Loading Mechanism

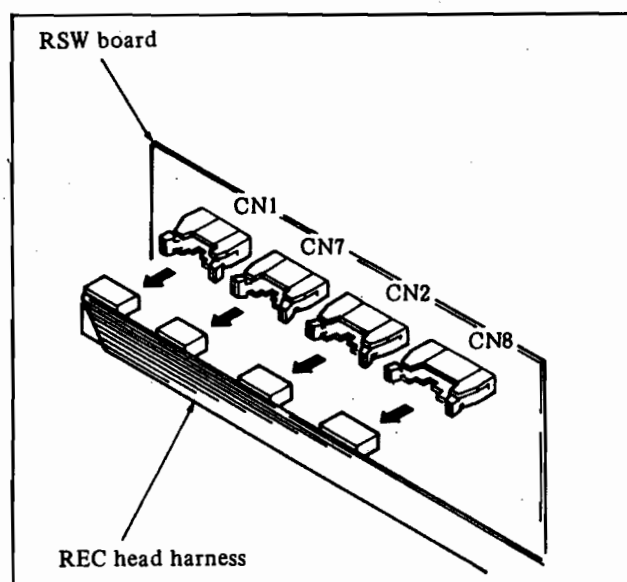
The tape loading mechanism should be replaced in the following instances:

1. When replacement is required as per the periodic inspection schedule (see Section 4);
2. When the geared motor no longer functions normally:
 - The tension arm does not retract when the tension disarm switch is pressed;
 - The geared motor will not stop running (note: if the cause is a malfunctioning lead switch, replace only the defective lead switch).

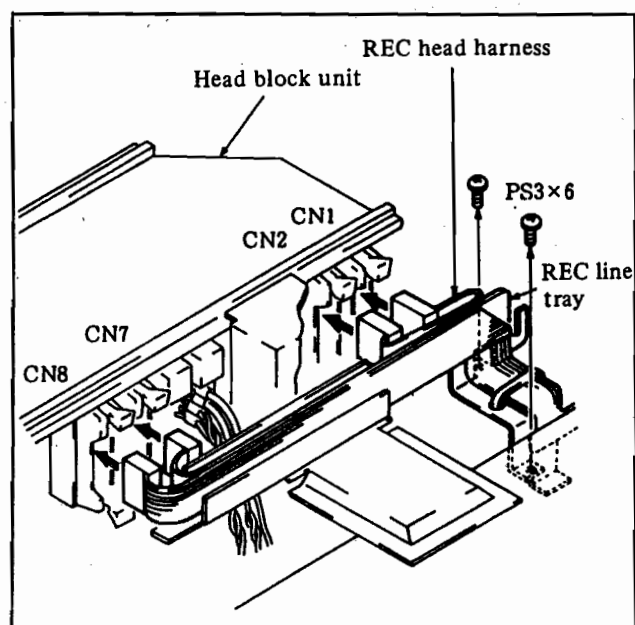
5.1.1 Replacing Peripheral Components of the Geared Motor

Replacement Procedures

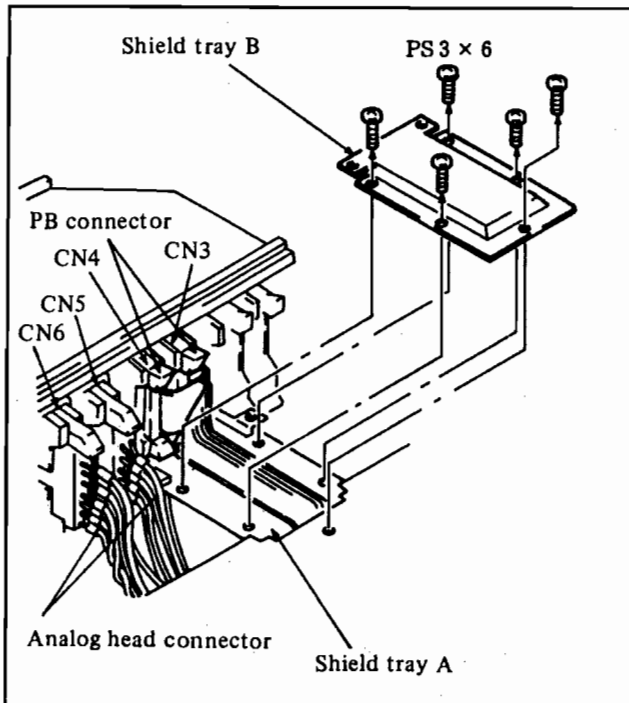
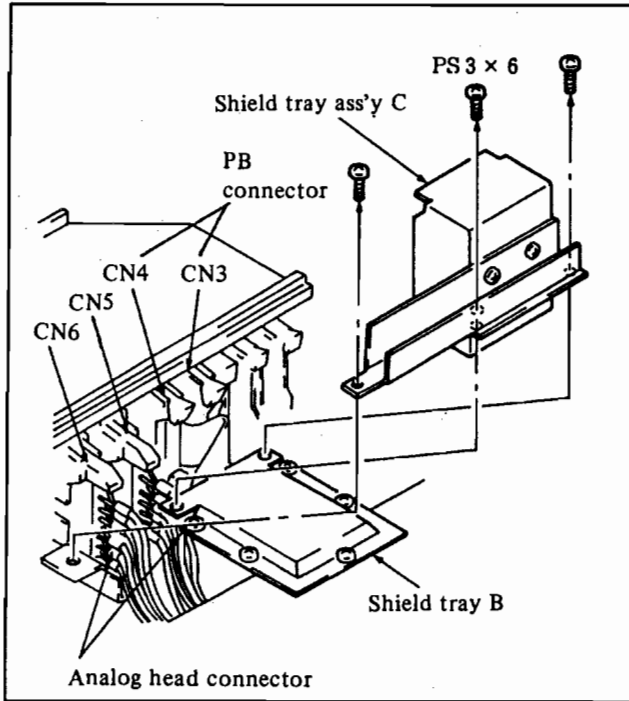
1. Remove the head cover.
2. Remove the upper center panel as directed in Section 3.2.1; use an L-shaped 2.3mm hexagonal wrench.
3. Disconnect the REC head harness connectors from the RSW board (see the figure below).



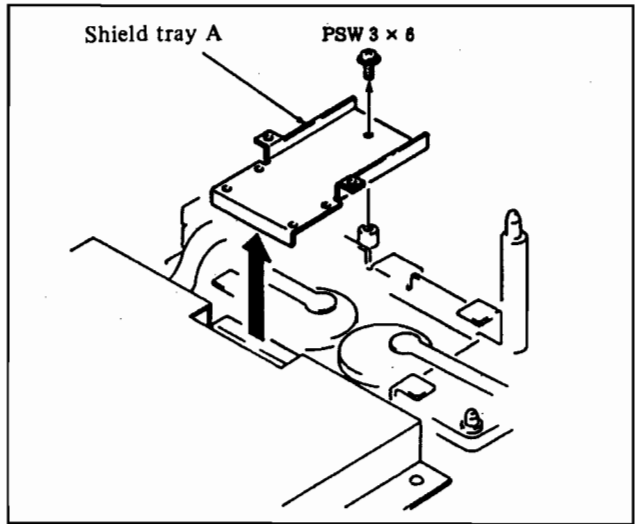
4. Disconnect the REC head harness connector from the head block unit, unfasten the two PS3 × 6 screws, and remove the harness together with the REC line tray (see the figure below).



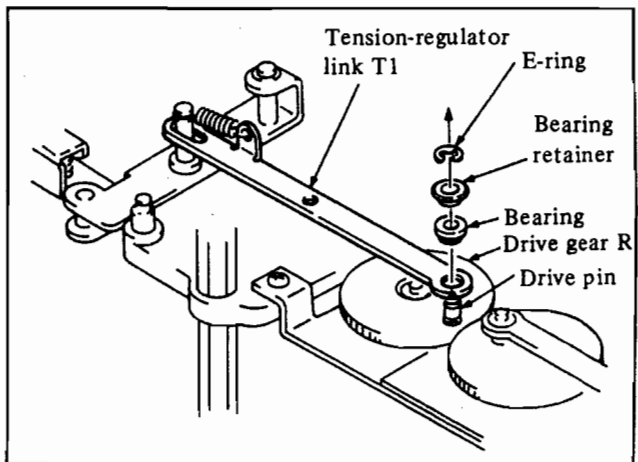
5. As shown in the figures below, remove the shield trays B and C, and disconnect the PB connectors and analog head connectors.



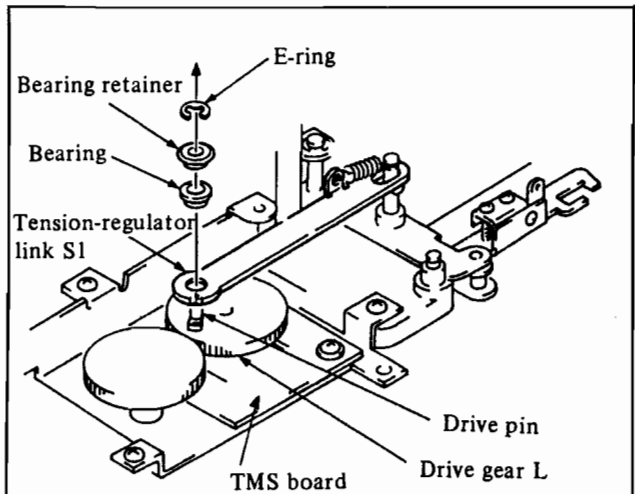
6. Remove shield tray A as shown in the figure below.



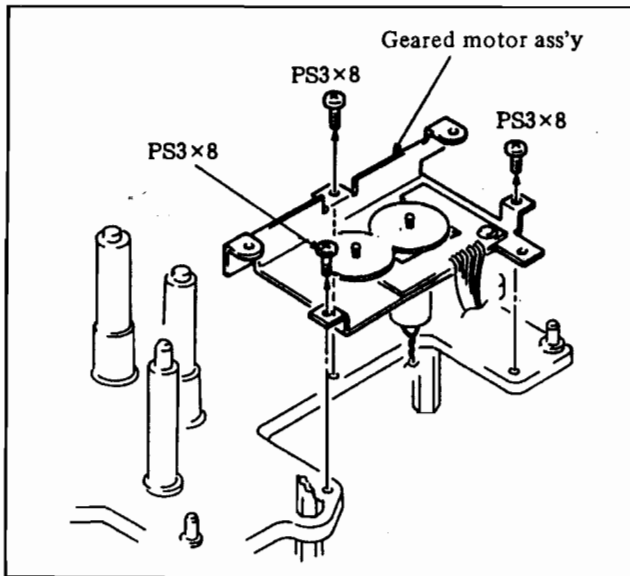
7. As shown the figure below, remove the E-ring from the pin and tension-regulator link T1 from drive gear R.



8. As shown the figure below, remove the E-ring and tension regulator link S1 from the drive gear L.



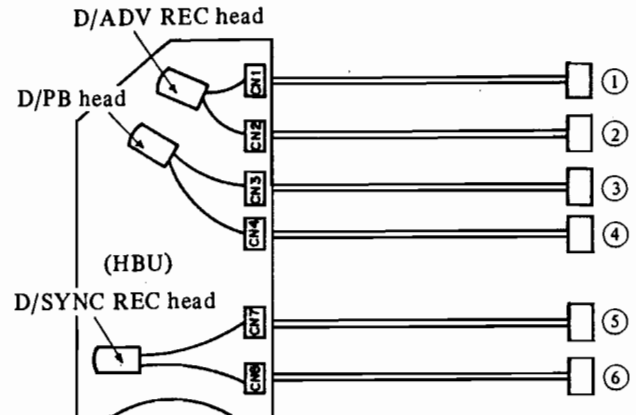
9. Remove the amp case (Refer to Section 5.7.1 Replacing the Tension Arm Assembly) and disconnect connectors CN2 (geared motor harness) and CN7 (lead SW harness) from the PLD board.
10. As shown the figure below, unfasten the three PS3 $\times$ 8 screws and remove the geared motor assembly by lifting it upward.



11. Install the new geared motor assembly as illustrated above: do not tighten the screws completely when driving them.
12. Plug harness connectors removed in step 9 into PLD board connectors CN2 and CN7, respectively.
13. Reinstall the amp case.
14. Reinstall tension-regulator link T1 as illustrated in the figure described in step 7 of sec. 5.1.1.
15. Reinstall tension-regulator link S1 as illustrated in the figure described in step 8 of sec. 5.1.1.
16. Tighten the three screws tentatively driven at step 12.
17. Perform steps 1 to 5 in reverse order.
18. Turn the power on, load a tape, and check whether the geared motor operates normally.

Note

If you replace the HBU flat cable when replacing the HBU or checking the head, bend the new flat cable and arrange it in the same way as the original one. Install the flat cable, referring to steps 3, 4 and 5.

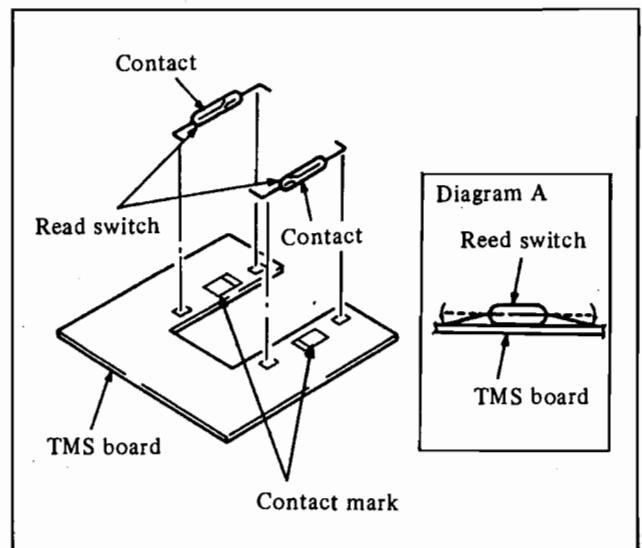


HBU Flat Cable Assy

- | | |
|---------------|---------------|
| ① : HBU1/RSW1 | ④ : HBU4/PRE4 |
| ② : HBU2/RSW2 | ⑤ : HBU7/RSW7 |
| ③ : HBU3/PRE3 | ⑥ : HBU8/RSW8 |

5.1.2 Replacing the Geared Motor Reed Switches

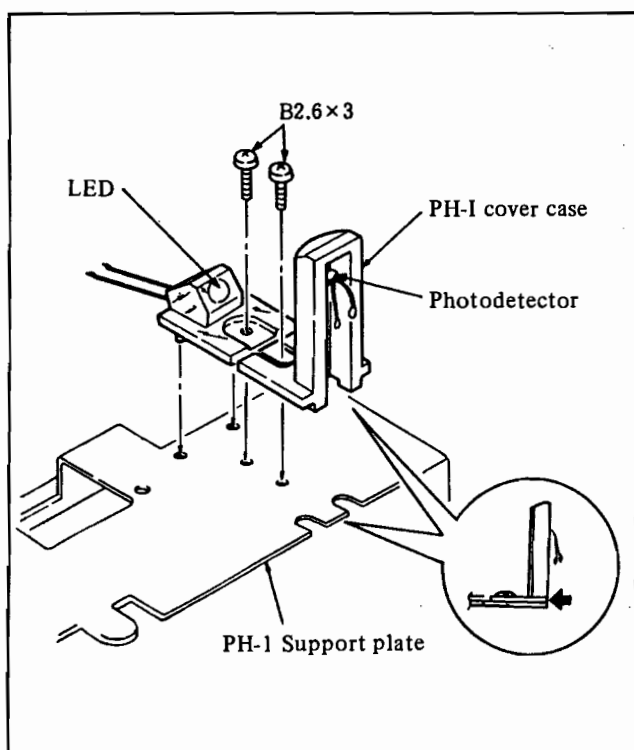
1. Remove components in the vicinity of the geared motor as directed in steps 1 to 7 of Section 5.1.1.
2. Loosen the drive gear L setscrew and remove the gear.
3. Use a soldering iron to remove reed switches to be replaced due to of defect or part life (see the figure below).
4. Bend the leads of the reed switches so that their glass bodies contact the TMS board, as shown in diagram A of the figure below, when the switches are mounted on the board.
5. Place the two new reed switches on the TMS board, align their contacts with the contact marks on the board, press them against the board, and solder their leads into place (see the figure below).
6. Replace components peripheral to the geared motor by following steps 1 to 7 of Section 5.1.1 in reverse sequence.



5.2 Adjusting the Tape Shutoff and Shuttle Mechanisms

5.2.1 Adjusting the Photodetector Position

Align the back of the PH-I cover case with the PH-I support plate, as indicated by the arrow in the detail, and tighten the screws to secure the cover in place (see the figure below). This adjustment is conducted so the beam from the light emitting diode is detected by the photodetector when no tape is present.



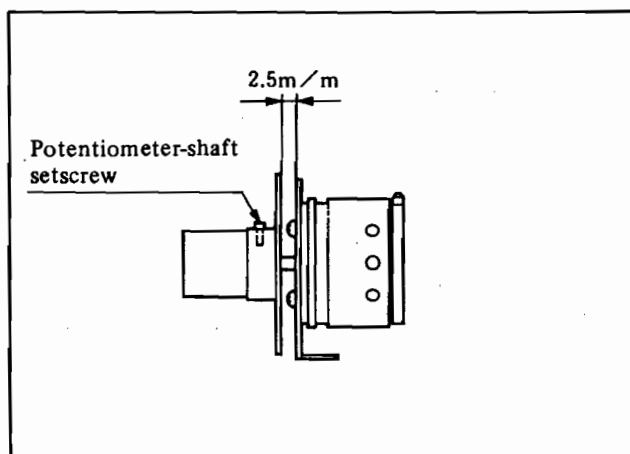
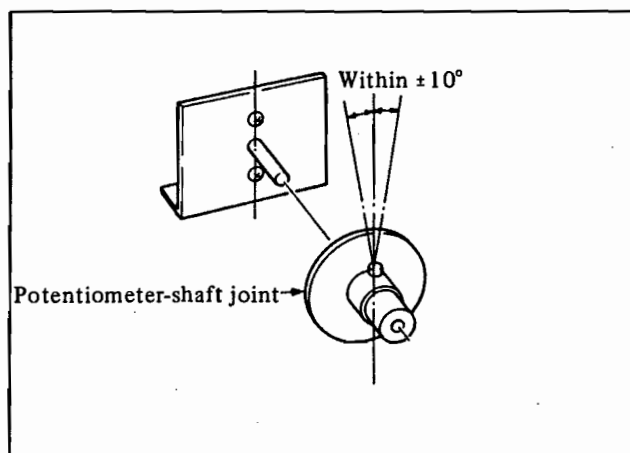
5.2.2 Adjusting the Shuttle Potentiometer Position

Required measuring instrument: voltmeter

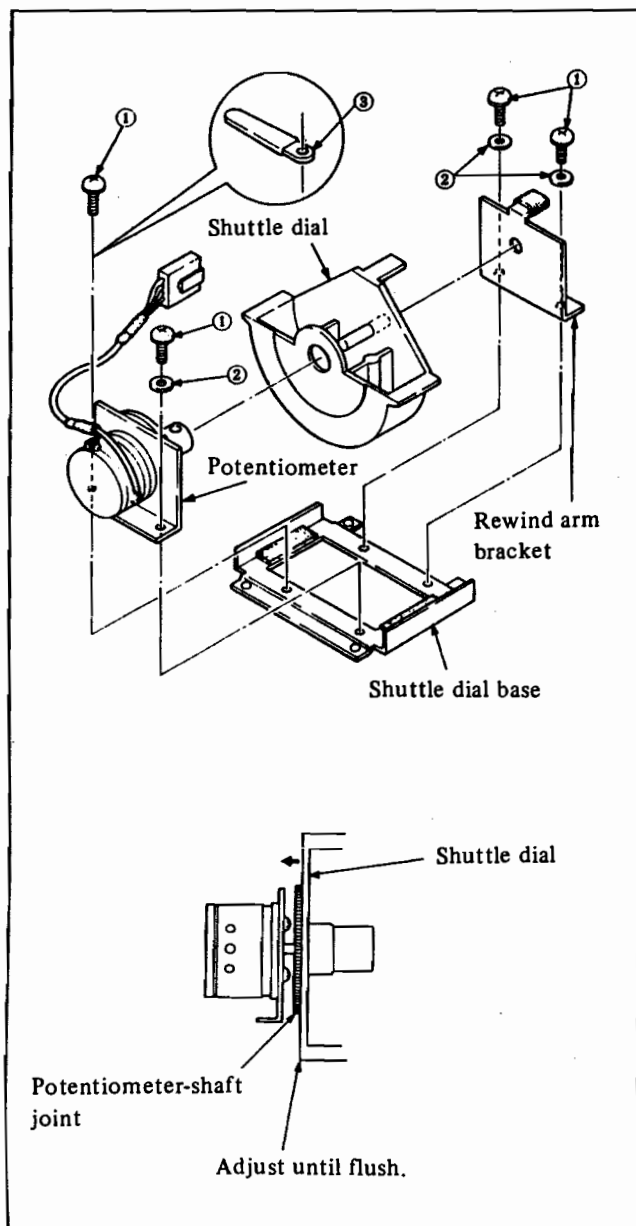
Required tools: 1.5mm hexagonal wrench

Assembly procedure

1. Open the function key panel.
2. Install the potentiometer onto the holder.
3. Insert the connector into KY-3 board connector CN2.
4. Turn the power on.
5. Tentatively adjust the potentiometer so that the following value is achieved by rotating the potentiometer shaft:
voltage at potentiometer terminals: $0 \pm 20\text{mV DC}$.
6. Carefully slide the potentiometer-shaft joint onto the potentiometer shaft as shown in the figure, below, and secure the potentiometer shaft setscrew.



7. Assemble the potentiometer and the shuttle dial as illustrated in the figure below.



Adjustment procedure

Tighten the shuttle dial setscrew while carefully rotating the potentiometer-shaft joint to obtain a reading of $0 \pm 10 \text{ mV}$ between terminals 2 and 4 of the potentiometer when the shuttle dial is at the middle position.

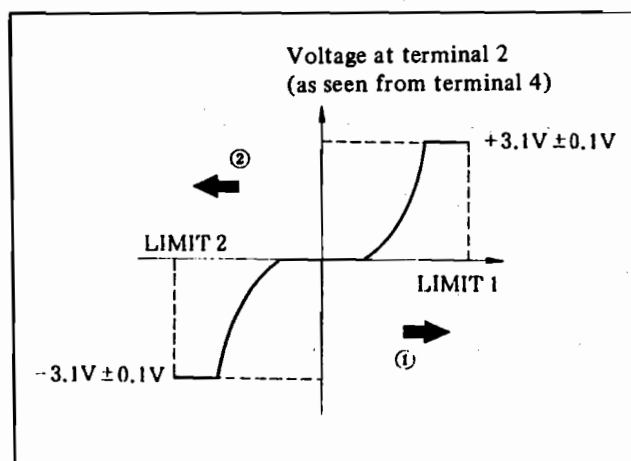
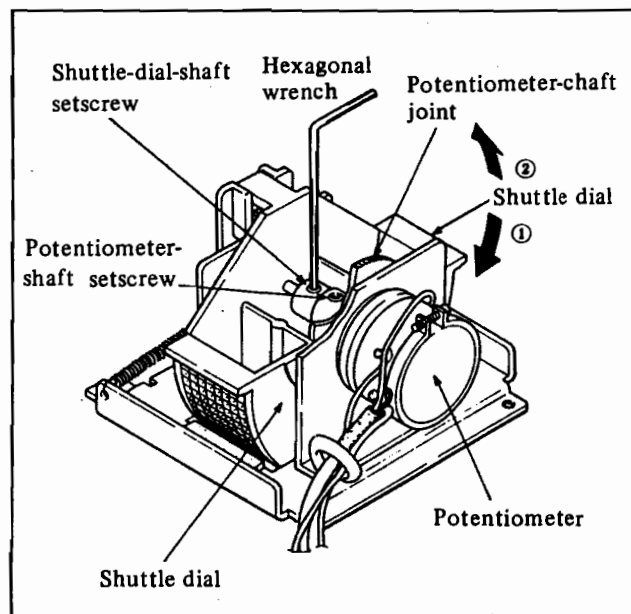
Note: Do not touch the dial when checking the voltage values.

Check

Rotate the shuttle dial fully in the direction of arrow ① and arrow ②, checking that the voltage values coincide with those prescribed below:

When the dial is rotated in the direction of arrow ①: Voltage between terminals 2 and 4: $+3.1 \pm 0.1 \text{ VDC}$ (terminal 4 = 0V);

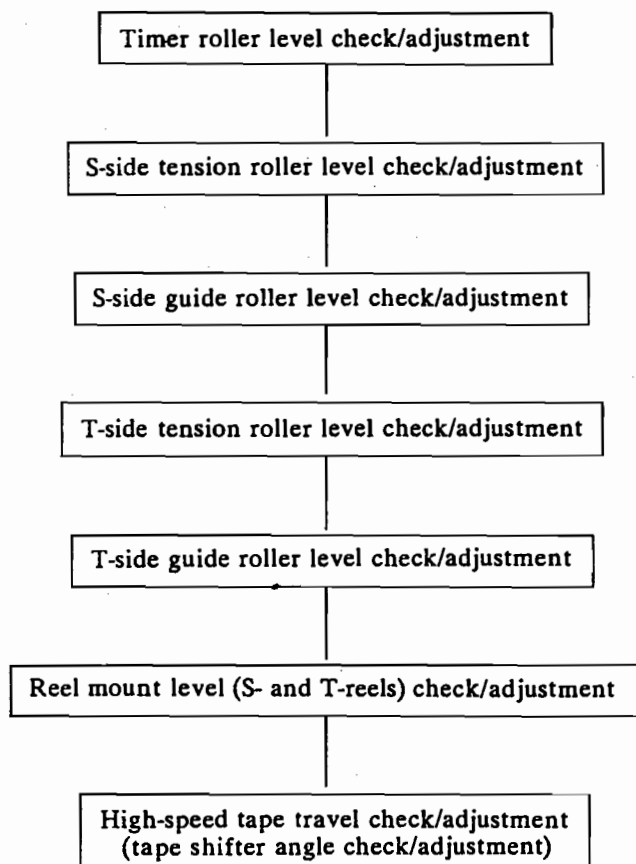
When the dial is rotated in the direction of arrow ②: Voltage between terminals 2 and 4: $-3.1 \pm 0.1 \text{ VDC}$ (terminal 4 = 0V).



5.3 Checking and Adjusting the Tape Transport System

5.3.1 Flow of Check and Adjustment Procedures

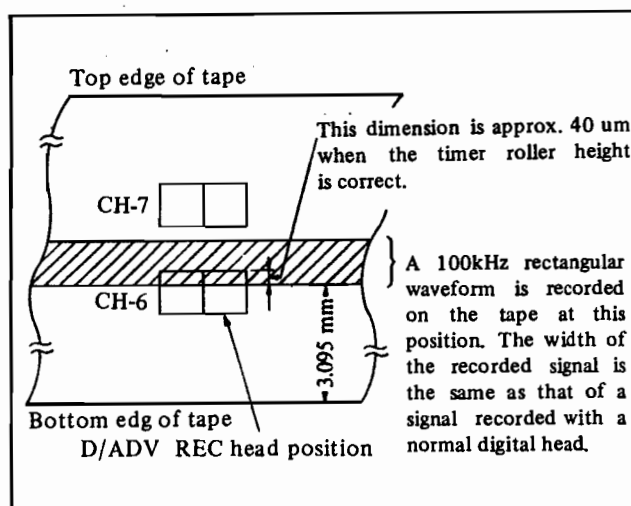
Conduct the check and adjustment items given in the flowchart below, in the sequence of their order, after replacing or adjusting components of the tape transport system (HBU, timer rollers, tension arms, guide rollers, etc.). If the adjustment carried out is one of those given below, conduct the check items listed subsequently, making adjustments only when checking proves them to be necessary.



5.3.2 Checking and Adjusting the Timer Roller Height

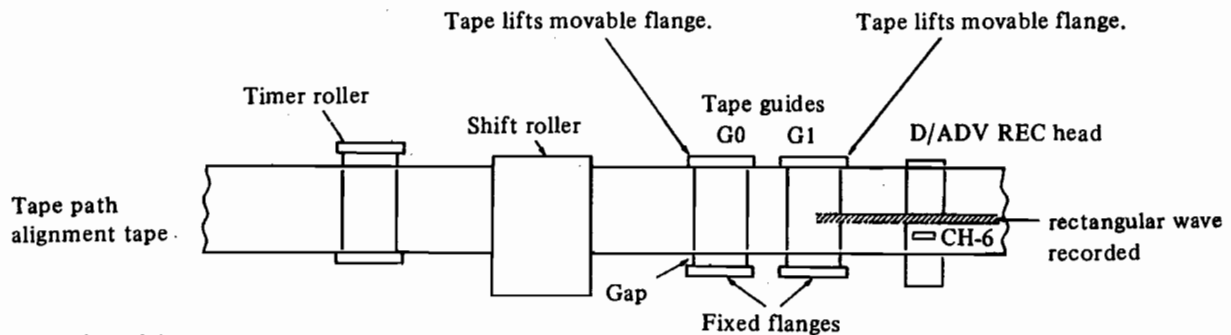
Fundamental principles

Always check and, if necessary, adjust the timer roller height after replacing a head assembly or the head block unit. Always adjust the timer roller height after replacing the timer roller. Use the "Tape path alignment tape (Sony-made)," on which a rectangular waveform is recorded in the location illustrated in the diagram below.



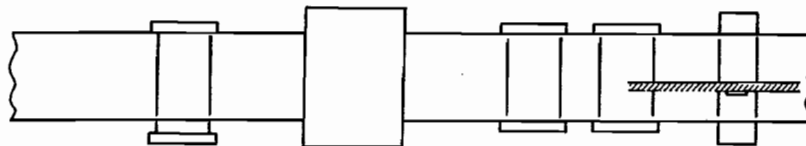
Caution; A custom-made tape might have been used in the field, in addition to the tape path alignment tape (8-960-080-01). When performing the adjustment, check the specifications of the tape before using.

Timer roller is too high:
(Illustration slightly exaggerates an example of misadjustment)



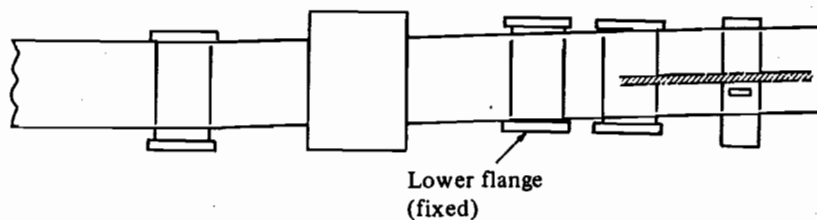
The top edge of the tape lifts the upper flange of the tape guides as it travels past them, and CH-6 of the head cannot trace the track on which the rectangular wave is recorded.

Timer roller height normal:



Head CH-6 and the track with rectangular-wave signal overlap about $40\text{ }\mu\text{m}$, thus the head can trace the track correctly.

Timer head too low:
(Illustration slightly exaggerates an example of misadjustment)



The tape seesaws on the lower flange of the tape guide as it travels past, and the tape pass by the head at a position higher than normal, causing the playback output to increase. When the timer roller is set so low that the head CH-6 and the rectangular wave track are totally miss one another, the bottom edge of the tape is pressed against the lower flange of the tape guide with such force that the tape curls.

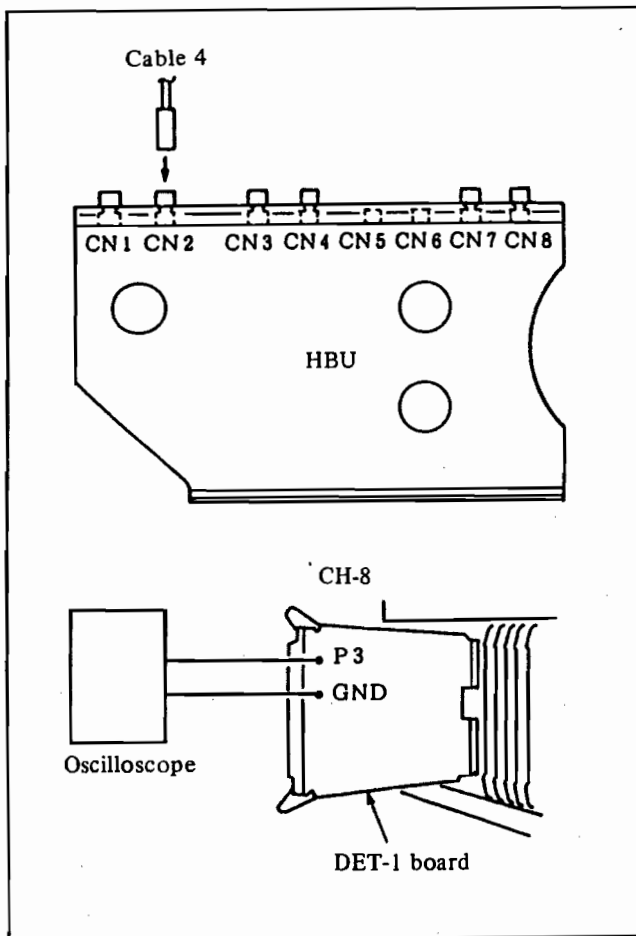
As a result, the width of head CH-6 and the rectangular wave track overlap excessively, causing the playback output to increase to an abnormally high level. Be careful not to be fooled into thinking that, because the output level is high, timer roller adjustment is correct.

Checking timer roller height

1. Remove the playback shield cases covering CN3 and CN4 of the HBU. Disconnect cable 2 from CN2 (D/ADV REC head). Unplug cable 4 from CN4 (D/PB head) and connect it to CN2; the D/ADV REC head will now play back the even-numbered channels.
2. Remove the DET-1 board, insert the extension board in its place and plug the DET-1 board into the extension board, then observe P3 (CH-6) on an oscilloscope.

Note: Turn the power OFF before mounting and dismounting circuit boards.

3. Play back the tape path alignment tape.
4. Lift the upper flange of tape guide G1 (the second one from the left inside the HBU, see the diagram at 5.3.2 "Timer roller is too high") upward with your finger. If the playback output reading at P3 is more than 1/2 of what it was before lifting the flange, no adjustment is necessary. Also, check to be sure that the bottom edge of the tape is not curling near the lower guide flange.

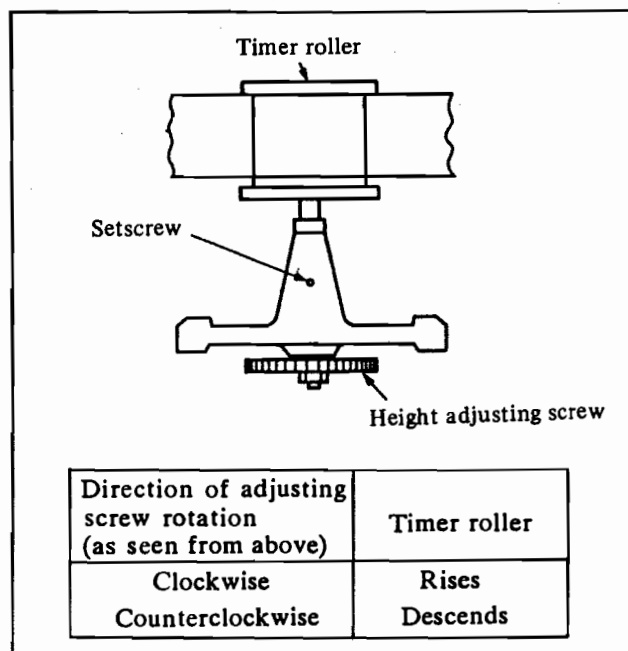


Adjusting timer roller height

Connect an oscilloscope to the DET-1 board as described previously at step 2 of the foregoing "Procedure for checking timer roller height."

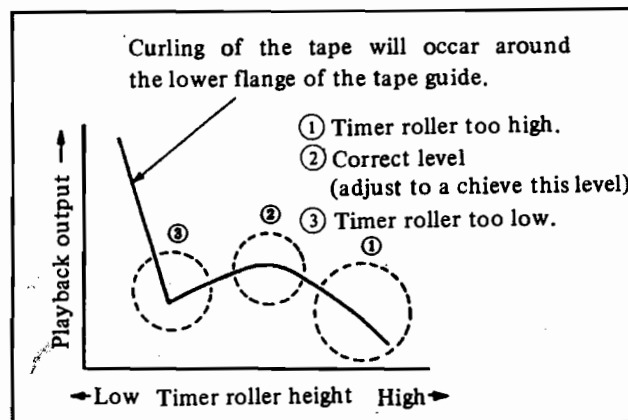
Rough adjustment

1. Loosen the timer roller setscrew and adjust the height adjusting screw to achieve the highest playback level possible. Loosely secure the setscrew.
2. Check make sure the tape is not floating, or curling because of being pressed against the lower tape guide flange.



Fine adjustment

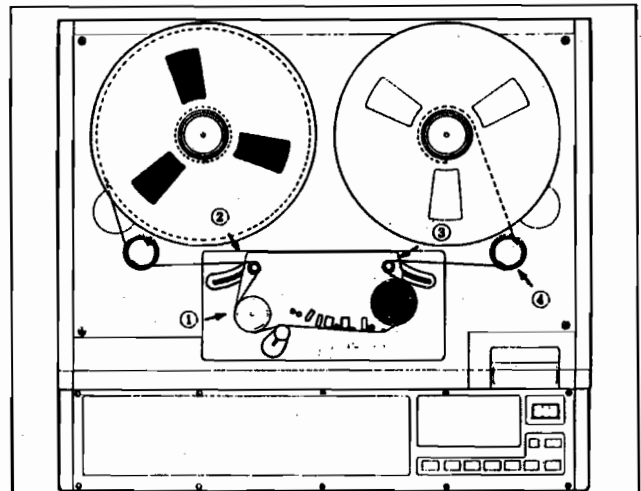
3. Lift tape guide G1 (second one from the left inside the HBU); if the playback level at P3 of CH-8 drops to less than 1/2 what it was before lifting the flange, the timer roller is probably positioned too high. Loosen the setscrew and turn the height adjusting screw slowly to lower the roller, then tighten the setscrew. Check the roller height again as directed in step 4 of the foregoing "procedure for checking timer roller height." Rotate the height adjusting screw only a little at a time since the necessary volume of adjustment is very minute.



4. Repeat the foregoing step 4 of the "Checking timer roller height" until the playback level is more than 1/2 the level before the flange is lifted. Once a satisfactory level is achieved, secure the adjusting and setscrews, reconnect cables 2 and 4 to CN2 and CN4, and return the playback shield cases and other parts to their original state.

If you should rotate the height adjusting screw so much that you lose a satisfactory level of the timer roller height, return to step 1 and start the timer roller height adjustment procedure over again from the beginning.

5.3.3 Checking and Adjusting S-side Tension Roller Height



Note: The arrows in the illustration above indicate the points to be observed and the direction of movement during the procedures described in the following, corresponding sections:

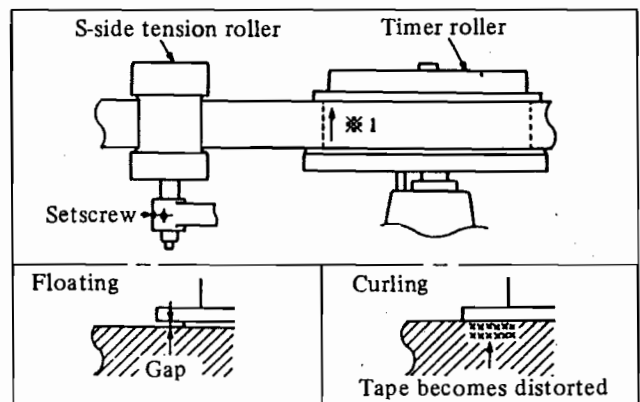
- ① 5.3.3 Checking and Adjusting S-side Tension Roller Height
- ② 5.3.4 Checking and Adjusting S-side Guide Roller Height
- ③ 5.3.5 Checking and Adjusting T-side Tension Roller Height
- ④ 5.3.6 Checking and Adjusting T-side Guide Roller Height

Checking the S-side tension roller height

1. Thread a blank tape and put the machine in the play mode.
2. Check that the tape neither curls nor floats at the entry point as it passes over the upper flange of the timer roller (point marked *1 in the following illustration).

Adjusting the S-side tension roller height

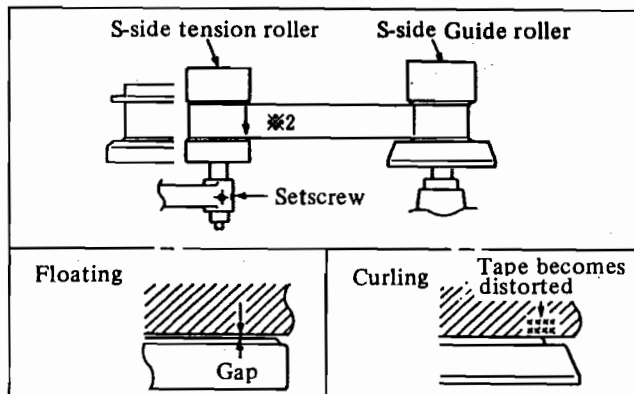
1. Thread a blank tape and put the machine in the play mode.
2. Loosen the setscrew of the S-side tension roller and rotate the roller cap so that the tape neither curls nor floats at the entry point as it passes over the upper flange of the timer roller (point marked *1 in the illustration).
3. Retighten the setscrew and check tape travel again.



534 Checking and Adjusting the S-side Guide Roller Height

Checking S-side guide roller Height

1. Thread a blank tape and put the machine in the play mode.
2. Check that the tape neither curls nor floats at the entry point onto the S-side tension roller near the roller's lower flange (point marked *2 in the following illustration).



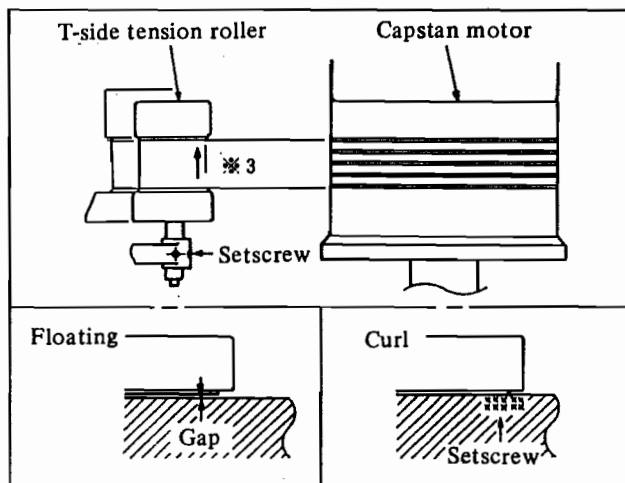
Adjusting S-side guide roller height

1. Thread a blank tape and put the machine in the play mode.
2. Loosen the setscrew of the S-side guide roller and rotate the roller cap so that the tape neither curls nor floats at the point of entry onto the S-side tension roller near the roller's lower flange (point marked *2 in the above illustration).
3. Retighten the setscrew and check tape travel again.

535 Checking and Adjusting T-side Tension Roller Height

Checking the T-side tension roller height

1. Thread a blank tape and put the machine in the play mode.
2. Check that the tape neither curls nor floats at the entry point as it passes over the upper flange of the T-side tension roller (point marked *3 in the following illustration).



Adjusting the T-side tension roller height

1. Thread a blank tape and put the machine in the play mode.
2. Loosen the setscrew of the T-side tension roller and rotate the roller cap so that the tape neither curls nor floats at the entry point as it passes by the upper flange of the T-side tension roller (point marked *3 in the illustration above).
3. Retighten the setscrew and check tape travel again.

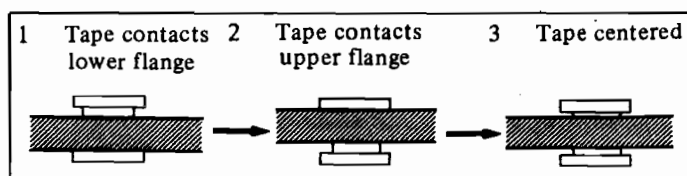
536 Checking and Adjusting the T-side Guide Roller Height

Checking T-side guide roller height

1. Thread a blank tape and put the machine in the play mode.
2. Check that the tape does not curl near the upper and lower flanges of the T-side guide rollers.

Adjusting T-side guide roller height

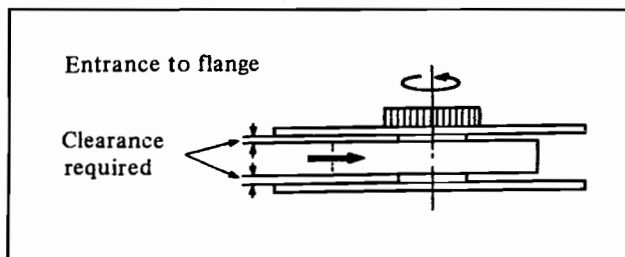
1. Thread a blank tape and put the machine in the play mode.
2. Loosen the setscrew of the T-side guide roller and rotate the roller cap to adjust the roller height so that the tape passes over the center of the rollers between the flanges.



5.3.7 Checking and Adjusting the Reel Table Height

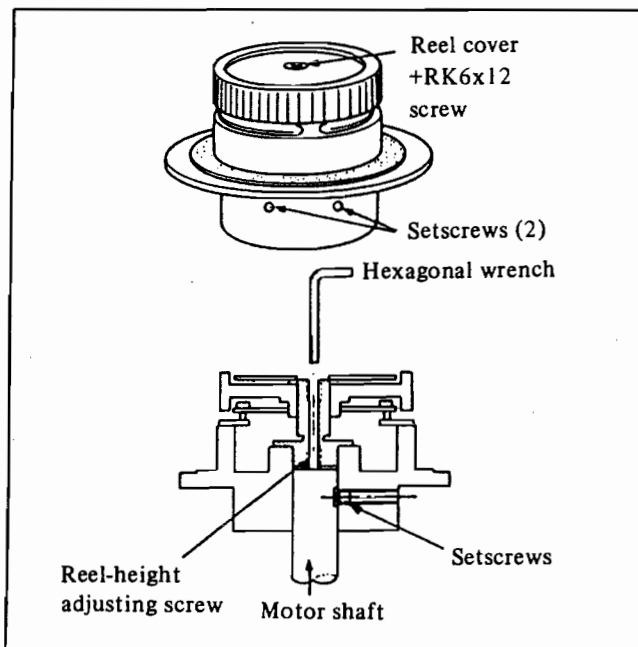
Checking reel table height

1. Load a blank tape and wind it onto the reel (procedure is the same for both reels) which is to be checked.
2. Verify that there is a gap between the tape and the both flanges at the point of entry onto the reel.



Adjusting reel table height

1. Loosen the two +RK6 x 12 screws with the 2mm hexagonal wrench and unfasten the +RK6 x 12 screws to remove the reel cover.



2. Load a blank tape and, in the shuttle mode, wind into onto the reel to be adjusted.
3. Insert the hexagonal wrench into the cover-fixing hole so that it fits into the reel-height adjusting screw. Adjust the reel table height by turning the height adjusting screw with the wrench so that the gap between the top and bottom edges of the tape and the respective reel flanges becomes equal.

Direction of adjusting-screw rotation	Direction of reel-table movement	
Clockwise	Rises	0.75mm/screw turn
Counterclockwise	Descends	

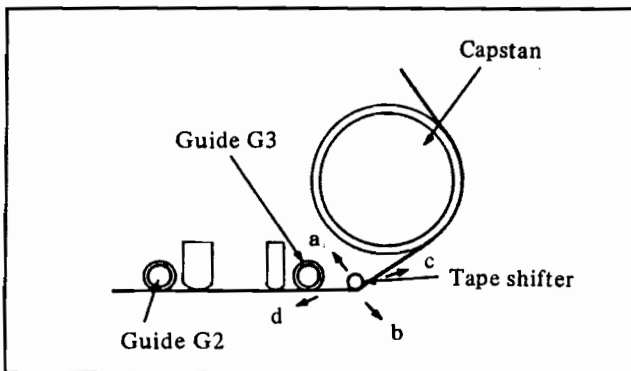
Note: When lowering a reel mount, you must press down on the table with your hand; its weight is not sufficient to cause it to descend by itself.

4. Tighten the two reel table setscrews and reinstall the reel cover with the +RK6 x 12 screws.

(Checking and adjusting the tape shifter slant)

1. Thread a blank tape, press the tension disarm switch, and put the machine in the loading mode.
2. Use the shuttle lever to run the tape in the FWD and REW directions and visually check that the variation in tape position as the tape travels past the tape shifter is within 0.5mm.

When, during FF and REW, the tape position varies vertically by more than 0.5mm from the standard position at PLAY, use the tape shifter bending tool (J14) to adjust the angle of the tape shifter, as required according to the guidelines given in the diagram and table below.



Shuttle forward	rises	descends	rises	descends
Shuttle reverse	rises	descends	descends	rises
Bend in direction	b	a	c	d

After tightening the setscrew of the timer roller, S- and T-side tension rollers, and the S- and T-side guide rollers, run a tape in the PLAY mode and check to make sure the tape is not floating or curling at the upper flanges of the S-side guide roller, Timer roller and T-side tension roller, and the lower flanges of the S-side tension roller, the HBU tape guides (G0 to G3) and the T-side guide roller.

5.4 Replacing and Adjusting the Shift Roller Mechanisms

5.4.1 Confirming Correct Performance

- (1) The shift rollers must not emit any abnormal noises when rotated with the finger (shift roller check).
- (2) Solenoid B must retract, pulling the shift roller back to its proper retracted position, when a reel is set and the tension disarm switch has been pressed (see 5.4.4, Replacing and Adjusting Solenoid B).
- (3) The shift roller must retract fully when the machine enters the PLAY mode (solenoid A check).

5.4.2 Replacing and Adjusting Solenoid A

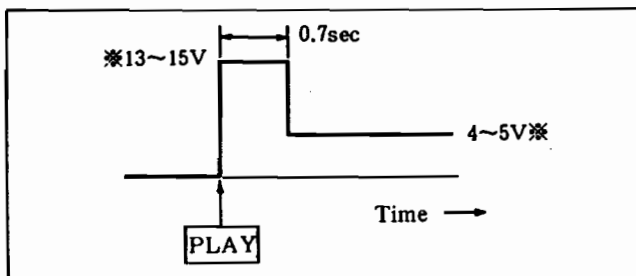
(1) When to replace

Replace solenoid A when either of the following conditions prevails:

1. When replacement is required according to the periodic inspection schedule (see Section 4);
2. When "5.4.1 Confirming Correct Performance" is not realized.

Before exchanging solenoids, check that voltage values on the PLD board are correct as directed below:

Unplug the PLD board's CN3 and check the voltage at the board's terminal; voltage values such as those illustrated below are normal. If the voltage readings are less than those marked with the asterisk (*) in the diagram, repair the PLD board.

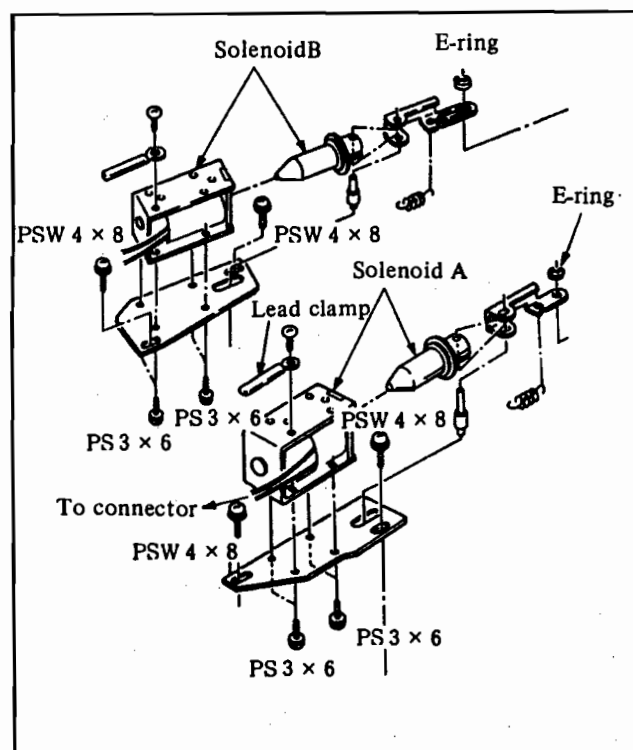


Note: Use solenoid A with the part number suffix -13. If a solenoid whose part number ends with -11 or -12 is used for solenoid A, replace the PLD board's C201 (100 / 16V chemical capacitor) with a 33 / 16V tantalum capacitor.

(2) How to replace

1. Remove the E-ring securing solenoid A and the two PSW4 x 8 screws.
2. Remove the four PS3 x 6 screws and the lead clamp, replace the solenoid, and secure the lead clamp back into place with the screw.
3. Install the solenoid assembly to the chassis and secure the assembly with the E-ring and the two PSW4 x 8 screws; do not tighten the screws completely.

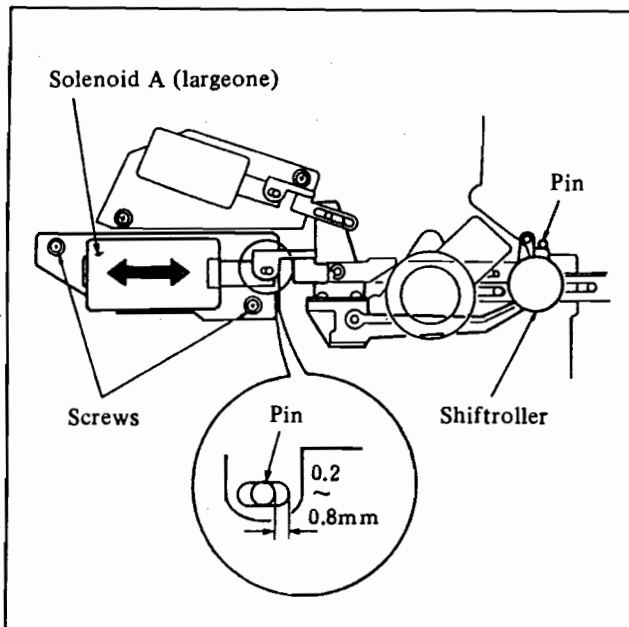
Reconnect the connector.



(3) How to adjust

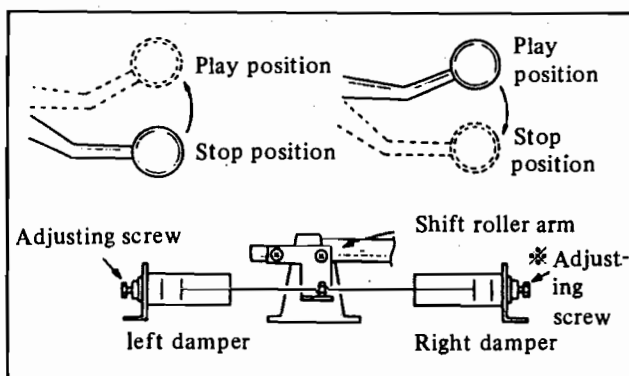
Adjusting the shift-roller PLAY-mode position

1. Load a any tape and press the tension disarm switch. Press the PLAY button and adjust solenoid A by moving it to or fro as required to achieve a gap of 0.2~0.8mm (see diagram below), then secure the two screws and apply screw-lock.



Adjusting the shift roller control dampers

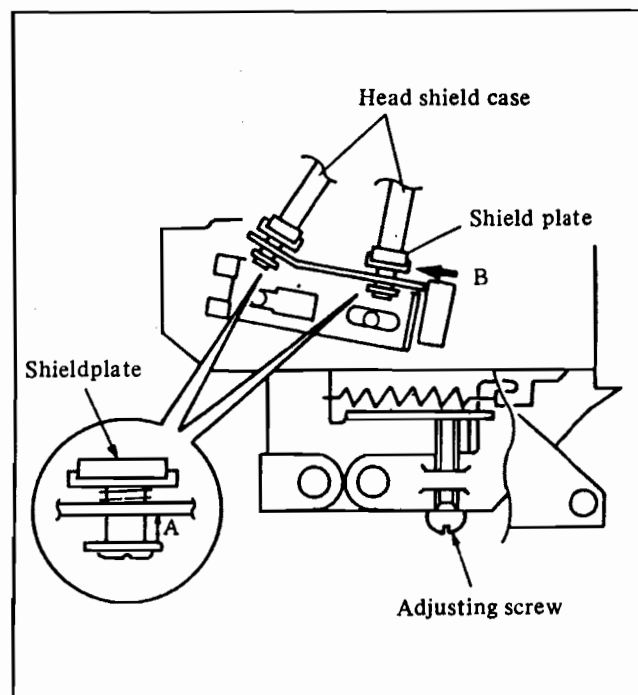
1. Load a blank tape. Adjust the left damper so that the shift roller retracts in 0.4 second when the PLAY button is pressed.
2. Adjust the right damper so that the shift roller returns to the stop position in 0.4 second when the STOP button is pressed.



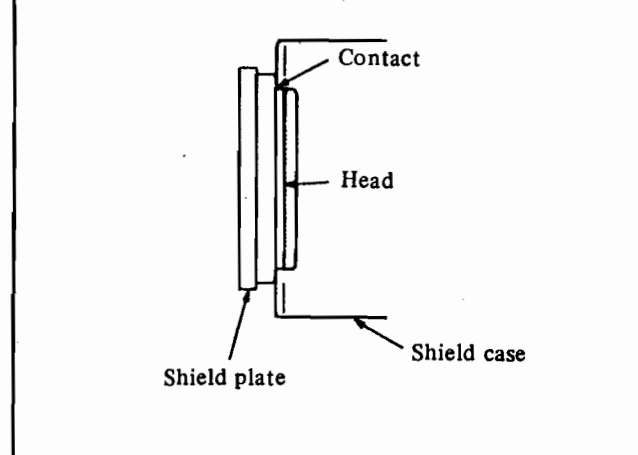
* Rotating the adjusting screw clockwise slows the retraction time of the shift roller; rotating it counterclockwise quickens the retraction time.

5.4.3 Head Shield Position

Rotate the adjusting screw (See the diagram below) so that the shield plate and the shield case of each head fully contact one another, and gap A (diagram below) becomes 0.2~1mm when the unit is in the PLAY mode.



(上図の矢印B方向から見た図)



Confirming performance

1. Plug in all connectors, load a tape, put the unit in the PLAY mode, and check that the shift roller retracts properly.

5.4.4 Replacing and Adjusting Solenoid B

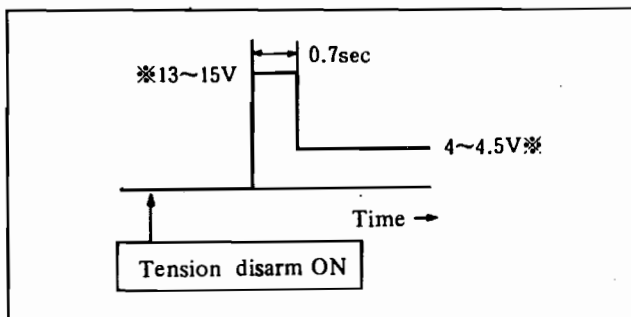
(1) When to replace

Replace solenoid B when either of the following conditions prevails:

1. When replacement is required according to the periodic inspection schedule (see Section 4);
2. When "5.4.1 Confirming Correct Performance" is not realized.

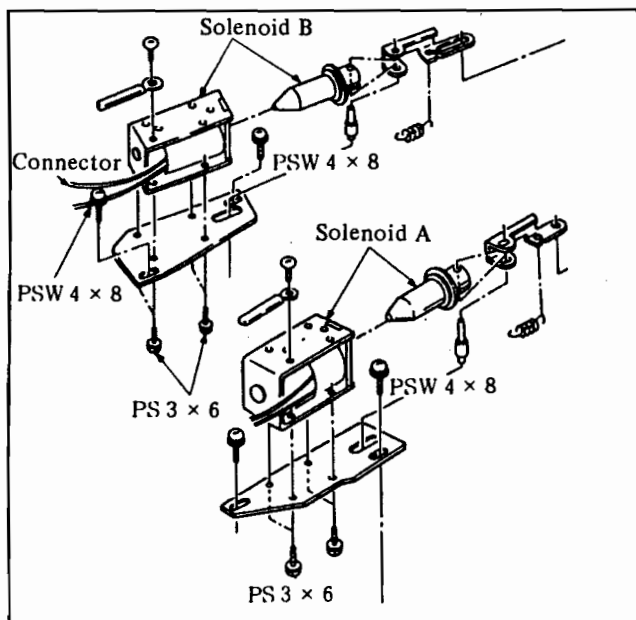
Before exchanging solenoids, check that voltage values on the PLD board are correct as directed below:

Unplug the PLD board's CN2 and check the voltage at the board's terminal; voltage values such as those illustrated below are normal. If the voltage readings are less than those marked with the asterisk (*) in the diagram, repair the PLD board.



(2) How to replace

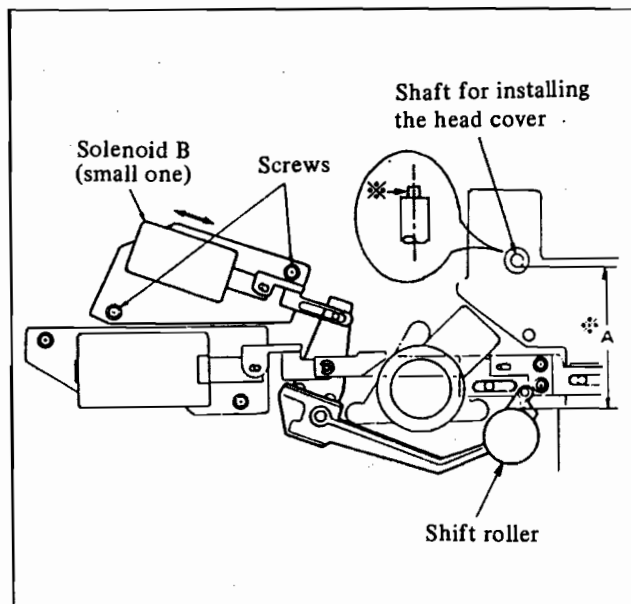
1. Remove the E-ring securing solenoid B and the two PSW4 x 8 screws, and disconnect the connector.
2. Remove the four PS3 x 6 screws and the lead clamp, replace the solenoid, and secure the lead clamp back into place with the screw.
3. Install the solenoid assembly to the chassis, secure the assembly with the E-ring and the two PSW4 x 8 screws (do not tighten completely), and connect the connector.



(3) How to adjust

Adjusting the shift-roller STOP-mode position

1. Press the tension disarm button and adjust the position of solenoid B by moving it to or from as required so that dimension A (diagram, below) becomes 78--79mm. Secure the two installation screws.



(4) How to confirm performance

1. Plug the connector into CN2 on the PLD board and confirm that the shift roller retracts to the correct position when a reel is mounted and the tension disarm button, pressed.

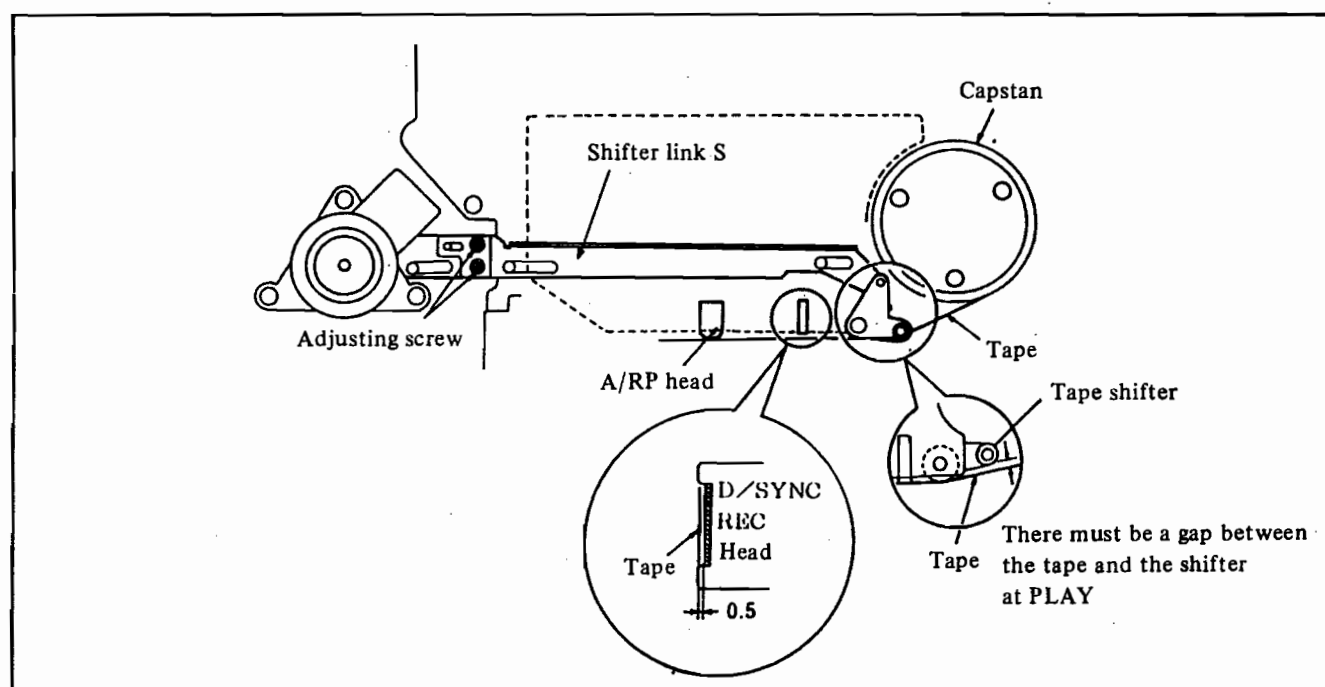
5.4.5 Checking and Adjusting the Tape Shifter Position

Checking tape shifter position

1. Load a blank tape and press the tension disarm button.
2. At this time, the gap between the tape and the D/SYNC REC head must be about 0.5mm.
3. There must be a gap between the tape and the shifter when the PLAY button has been pressed.

Adjusting tape shifter position

Loosen the two adjusting screws, move the shifter link S to the left or right so that the gap becomes about 0.5mm, and tighten the adjusting screws.



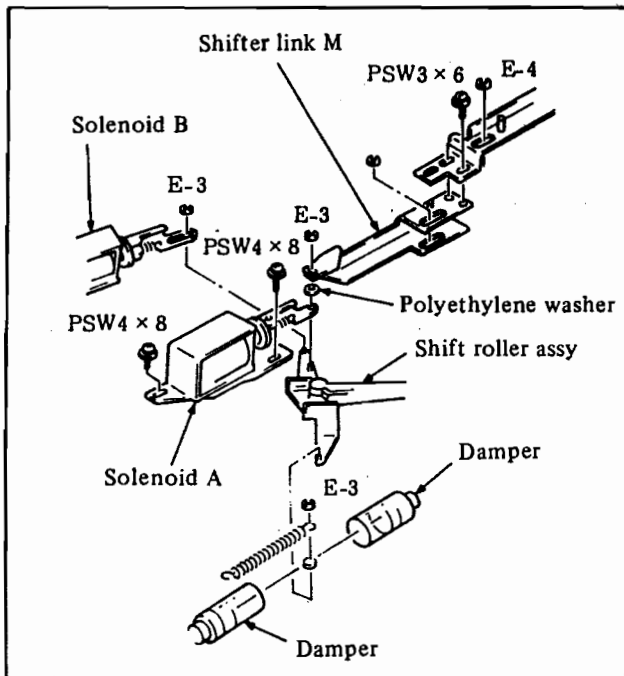
5.4.6 Replacing and Adjusting the Shift Roller Assembly

(1) When to replace

Replace the shift roller assembly when required by the periodic inspection schedule (see Section 4).

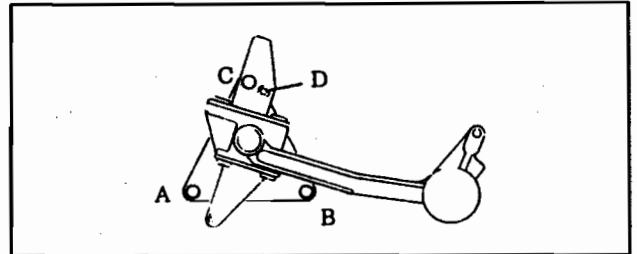
(2) How to replace

1. Remove the three E-rings from the shift roller assembly pins.
2. Remove the two screws securing solenoid A.
3. Remove the two PSW3 X 6 screws securing shifter link S.
4. Remove shifter link M and solenoid A from the shift roller assembly (be careful of the polyethylene washers).
5. Push the arm of solenoid B upward to separate it from the pin.



6. Remove the dampers and springs from the shaft of the shift roller assembly.
7. Unfasten the three M4 X 12 hexagonal socket-head screws securing the shift roller and remove the roller assembly.
8. Inspect the new roller assembly to be sure its roller is not damaged, then check for abnormal noises by rotating the roller manually.

9. Place the new shift roller onto the chassis, insert a roller assembly positioning jig into holes A and B, and secure C with an M4 X 12 hexagonal socket-head screw.



10. Secure A and B with M4 X 12 hexagonal socket-head screws.
11. Reassemble the shift roller, solenoids, and dampers by conducting steps 1 to 6 in reverse sequence (apply Sony SGL-501 grease to shaft D at the time of reassembly).
12. Clean the roller.

(3) How to adjust

1. Adjust the shift roller STOP-mode position according to the instructions at 5.4.4 (3).
2. Adjust the shift roller PLAY-mode position according to the instructions at 5.4.2 (3).
3. Adjust the tape shifter position according to the instructions at 5.4.5.
4. Adjust the head surface shield position according to the instructions at 5.4.3.
5. Check the timer roller level and tape travel at high speeds according to the instructions at 5.3.2 and 5.3.8.

5.4.7 Replacing the Shift Roller and Shift Roller Bearings

(1) When to replace

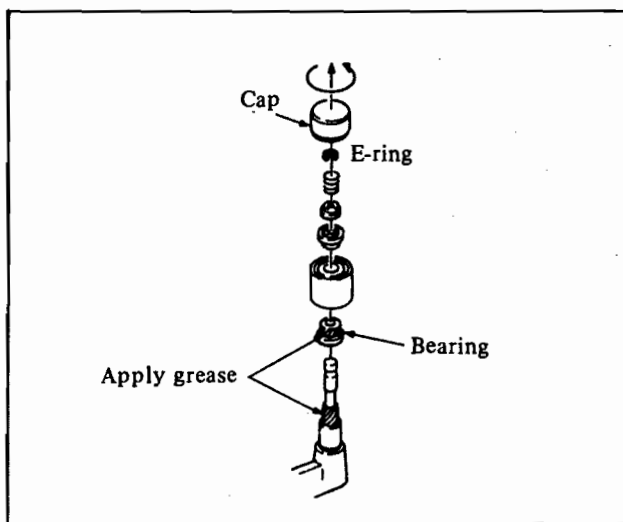
1. Replace the shift roller and shift roller bearings as required by the periodic inspection schedule. It is not necessary to replace these parts when the whole shift roller assembly is replaced.

(3) How to adjust

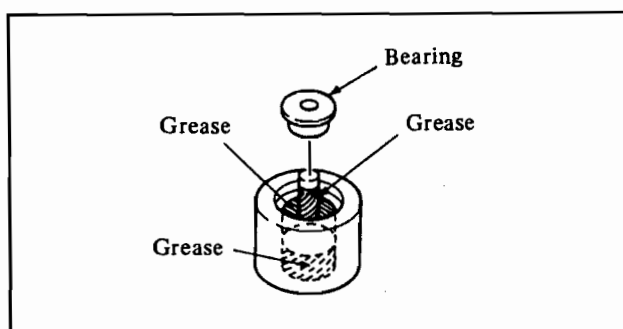
No adjustment is necessary.

(2) How to replace

1. Remove the cap by rotating it as show below.
2. Remove the E-ring and the roller.
3. Inspect the new shift roller for damage.
4. Apply Sony SGL-501 grease to the inclined sections of the shaft and the bearing, and slide the bearing onto the shaft.



5. Install the new roller.
6. Apply Sony SGL-501 grease to the incline area of the shaft and the inside of the roller, and slide the upper bearing onto the shaft, inserting into the roller.



7. Insert the GR collar and the spring, set the E-ring back into place, and close the roller cap.
8. Rotate the roller manually to check for abnormal noises.

5.5 Replacing and Adjusting the Tape Shifter

5.5.1 Replacing the Tape Shifter

(1) When to replace

Two types of tape shifters are used on PCM-3324s. These are differentiated by the material of the surface that contacts the tape:

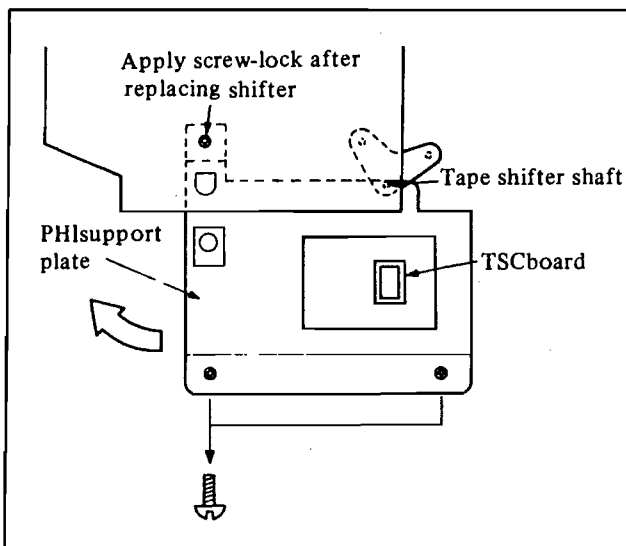
Metallic shifters (part no. X-4882-430-0, used in the set of units up to serial no. 11900)

Ceramic shifters (part no. X-4882-430-3, used in the set of units of serial no. 11901 and higher).

Since the metallic shifters wear more quickly than the ceramic shifters, replace them with ceramic shifters after about 1,500 hours use (according to the head hour meter on the rear panel). Thereafter, replace the ceramic shifters as required by the periodic inspection schedule in Section 4; the inspection schedule has been composed on the assumption that ceramic shifters are being used.

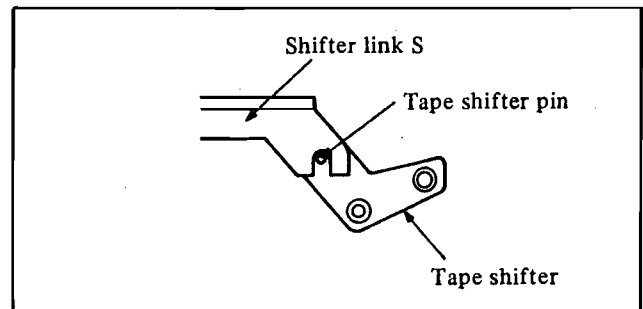
(2) How to replace

1. Remove transport tables A, B, and C as directed in Section 3.
2. Unfasten the two screws and remove the TSC board.



3. Remove the two springs latched onto the PH-I support plate, unfasten the two screws, and rotate the PH-I support plate clockwise until the rotating shaft of tape shifter comes into view.
4. Remove the E-3 E-rings from the tape shifter.
5. Attach the spring plate and the springs from the old tape shifter to the new tape shifter with the PS3 X 6 screw.

6. Align the tape shifter pin with the elongated pin hole in shifter link S and install the shifter.



7. Attach the springs to the PH-I support plate and secure the plate with the two screws.
8. Place the TSC board back into place and fasten the two screws.
9. Apply screw-lock to the last screw of the PH-I support plate to prevent it from working loose.
10. Reinstall all other removed parts by conducting the disassembly procedure in reverse sequence.

5.5.2 Adjusting Tape Travel at High Speeds

Check and adjust as necessary the tape travel as directed in 5.3.8.

5.6 Replacing and Adjusting the Timer Roller

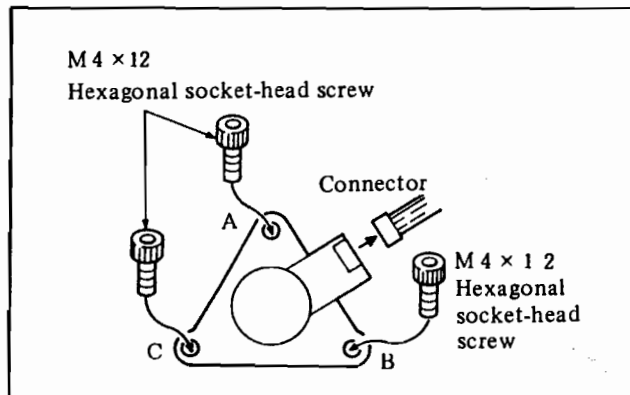
5.6.1 Replacing and Adjusting the Timer Roller Assembly

(1) When to replace

Replace the timer roller assembly when required by the periodic inspection schedule (see Section 4).

(2) How to replace

1. Unfasten the M4 X 12 hexagonal socket-head screw securing the timer roller assembly.
2. Disconnect the connector.
3. Inspect the roller and flanges of the new assembly for damage, and check for abnormal noise by rotating the roller manually.
4. Place the new timer roller onto the chassis, insert a roller assembly positioning jig into holes A and B, and secure C with one of the M4 X 12 hexagonal socket-head screws.
5. Secure A and B with the other two M4 X 12 hexagonal socket-head screws.
6. Plug in the connector.
7. Clean the roller.



(3) How to adjust

Adjust the timer roller level as directed in 5.3.2.

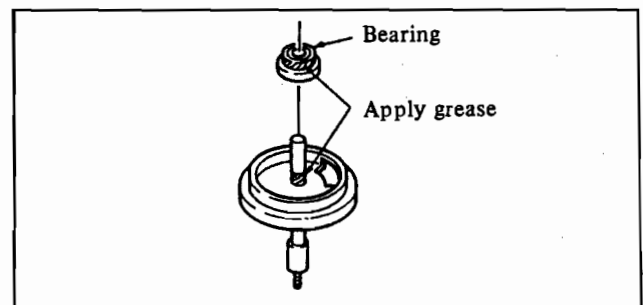
5.6.2 Replacing the Timer Roller Bearings

(1) When to replace

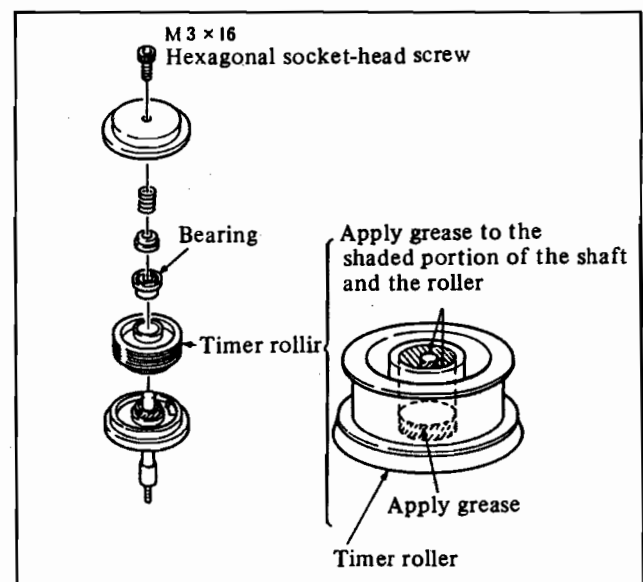
Replace the timer roller bearings when required by the periodic inspection schedule in Section 4, or whenever the timer roller begins to generate abnormal noise.

(2) How to replace

1. Loosen the M3 X 6 hexagonal socket-head screw securing the upper flange of the timer roller and remove the timer roller and bearings.
2. Apply Sony SGL-501 grease to the inclined areas of the shaft and the new, lower bearing and slide the bearing onto the shaft.



3. Place the roller onto the shaft.
4. Apply Sony SGL-501 grease to the inclined areas of the shaft and the roller, and slide the new, upper bearing onto the shaft.
5. Set the GR collar, the spring, and the upper timer roller flange onto the shaft and secure the flange in place with the M3 X 16 hexagonal socket-head screw.
6. Check for abnormal noises by rotating the roller manually.
7. Clean the roller.



(3) How to adjust

Adjust the timer roller level as directed in 5.3.2.

5.7 Replacing and Adjusting the Tension Arm

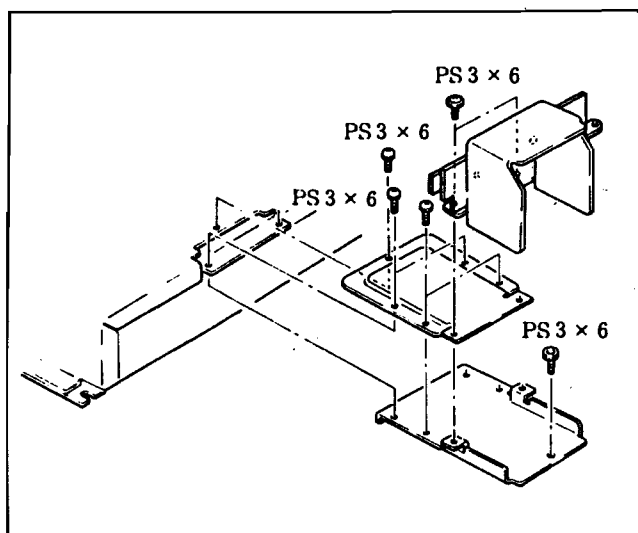
5.7.1 Replacing the Tension Arm Assembly

(1) When to replace

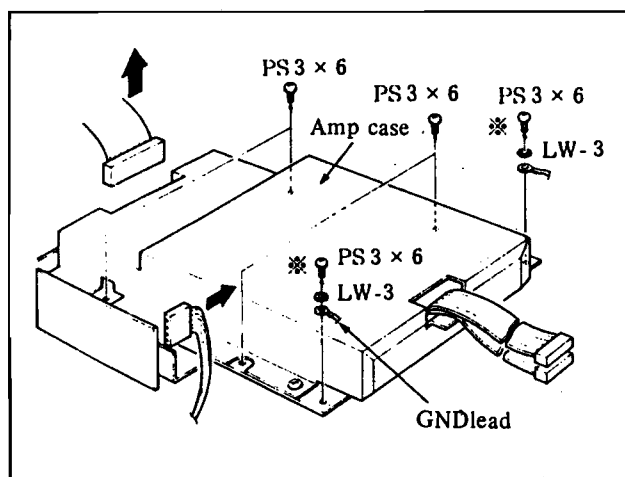
Replace the tension arm assembly when required by the periodic inspection schedule in Section 4.

(2) How to replace the S-side tension arm

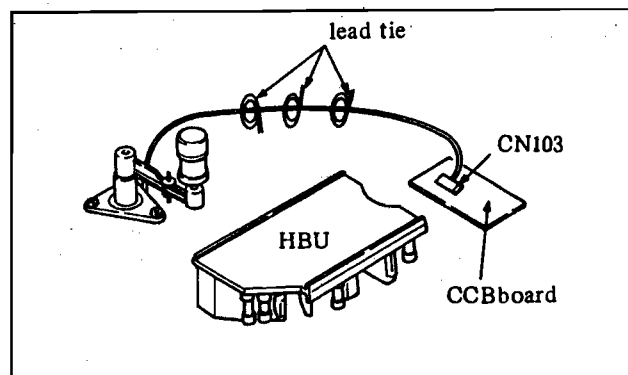
1. Unfasten the nine PS3 X 6 screws at the rear of the HBU and remove the parts shown below; also, disconnect connectors CN3 and CN4 when they can be accessed.



2. Disconnect the two connectors as shown by the arrows in the illustration below.
3. Unfasten the six PS3 X 6 screws as shown below. Note: the screws marked with an asterisk (*) are also used to fasten the GND leads to the amp case.
4. Remove the amp case.

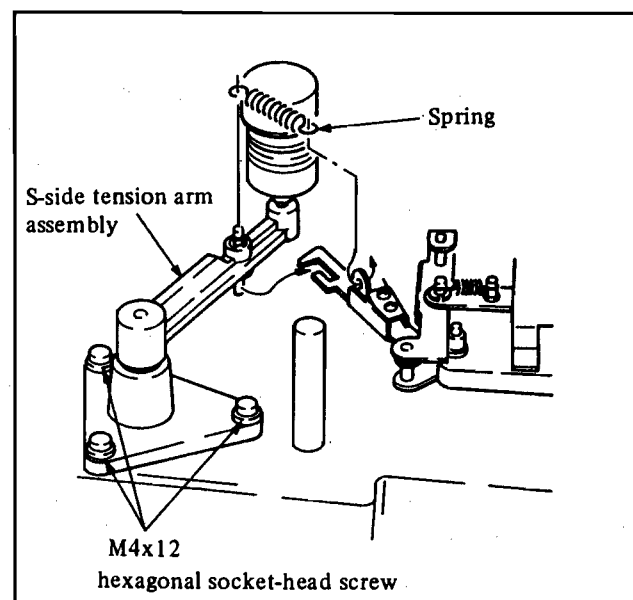


5. Disconnect CN103 from the CCB board, and cut and remove the lead bands from the wires.



6. Unhook the spring from the tension arm (see illustration below).
7. Unfasten the three M4 X 6 hexagonal socket-head screws securing the S-side tension arm assembly.
8. Remove the S-side tension arm assembly.
9. Set the new tension arm assembly onto the chassis, insert roller assembly positioning jigs into to of the holes in the base, and place one of the hexagonal socket-head screws into the remaining hole and secure the screw.
10. Remove the positioning jigs and set the other two hexagonal socket-head screws into the holes and tighten them.
11. Put all disassembled parts back into place by conducting steps 1 to 6 in reverse sequence.
12. Clean the roller.

After reassembling, conduct adjustments as described in (4) "How to adjust."



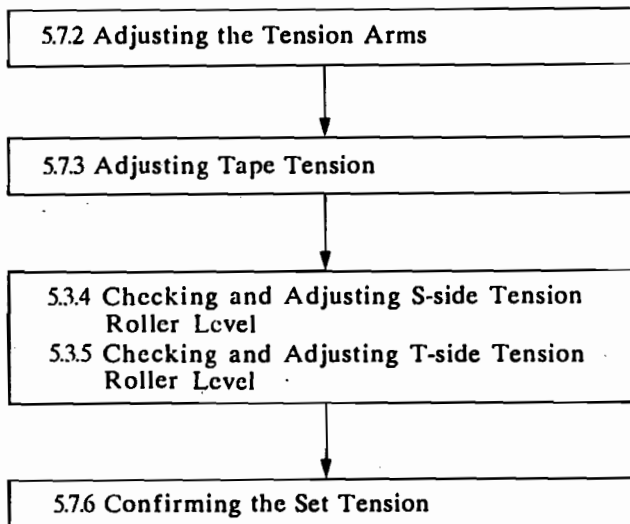
(3) How to replace the T-side tension arm assembly

Note: Refer to the diagrams in the foregoing section ("How to replace the S-side tension arm assembly") while replacing the T-side tension arm assembly.

1. Disconnect CN102 from the CCB board, and cut and remove all lead bands.
2. Unhook the spring from the tension arm.
3. Unfasten the three M4 X 12 hexagonal socket-head screws securing the T-side tension arm.
4. Remove the T-side tension arm assembly.
5. Set the new tension arm assembly onto the chassis, insert roller assembly positioning jigs into two of the holes in the base, and place one of the hexagonal socket-head screws into the remaining hole and secure the screw.
6. Remove the positioning jigs and set the other two hexagonal socket-head screws into the holes and tighten them.
7. Set the spring back into place.
8. Plug the connector into CN102 on the CCB board and arrange the lead wires neatly.
9. Clean the rollers.

(4) How to adjust

Conduct the adjustments in the flowchart below after completing replacement procedures.

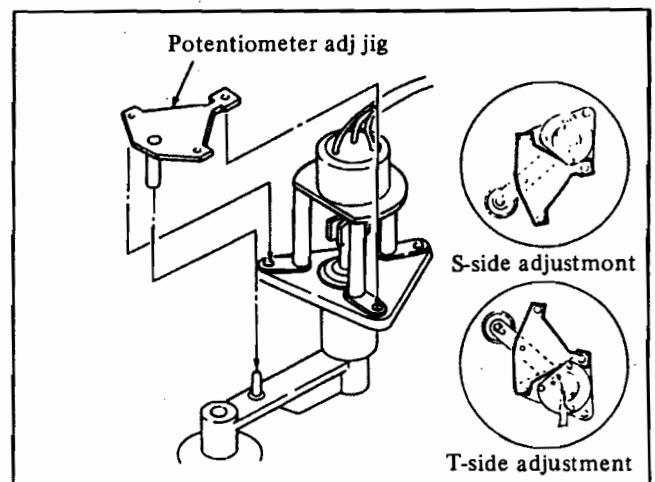


5.7.2 Adjusting the Tension Arms

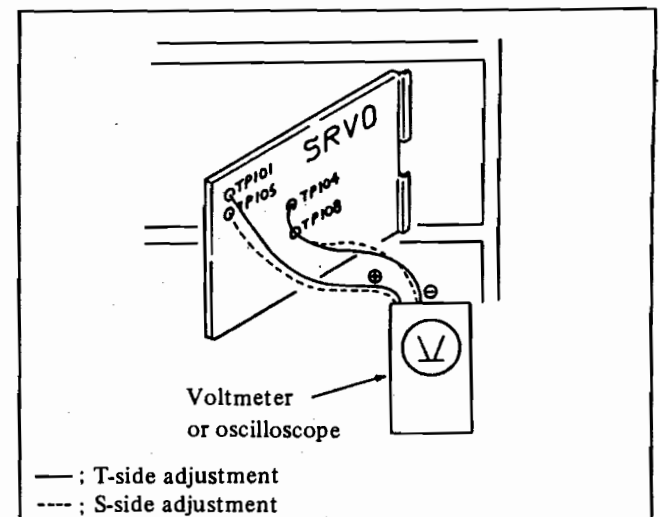
The following adjustments must be carried out on the tension arm assemblies after disassembly and reassembly work. Adjustment (1), Positioning the tension-detect potentiometer, may be omitted after replacing a tension arm assembly as a unit, but adjustment (2) should be conducted.

(1) Positioning the tension-detect potentiometer

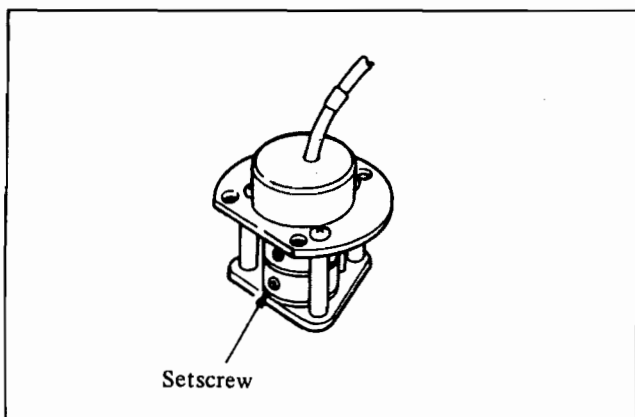
1. Install a tension regulator/potentiometer adjustment jig (J10) onto the removed tension arm assembly (see diagram below).



2. Connect a voltmeter to the test points on the SRVO board as illustrated below.

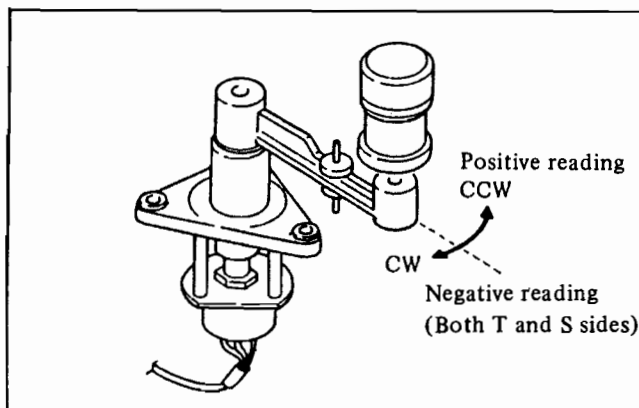


3. Turn the power switch on.
4. Loosen the setscrew of the coupler and turn the coupler of the tension arm assembly until a reading of $0V \pm 10mV$ is obtained on the voltmeter, and secure the coupler in this position by tightening the setscrew.



5. Remove the adjustment jig from the assembly. Viewing the tension arm from above, move the arm about 30° clockwise from point 0 established with the jig to confirm a minus voltage reading, then move the arm 30° counterclockwise from point 0 to confirm a positive reading (see the table and chart below). If polarity readings opposite the desire readings are obtained, shift the coupler position by 180° to obtain the correct polarity.

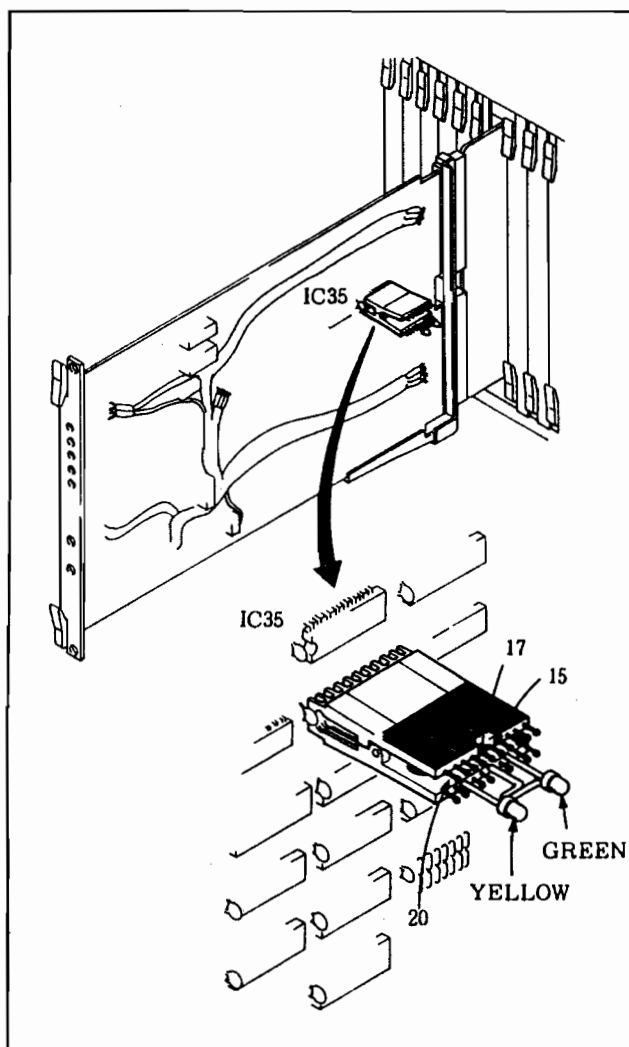
Tension arm	Test point		Voltage readings
	+	-	
T-side	TP101	TP104	
S-side	TP105	TP108	



(2) Adjusting low-tension detection (SRVO board)

Preparation

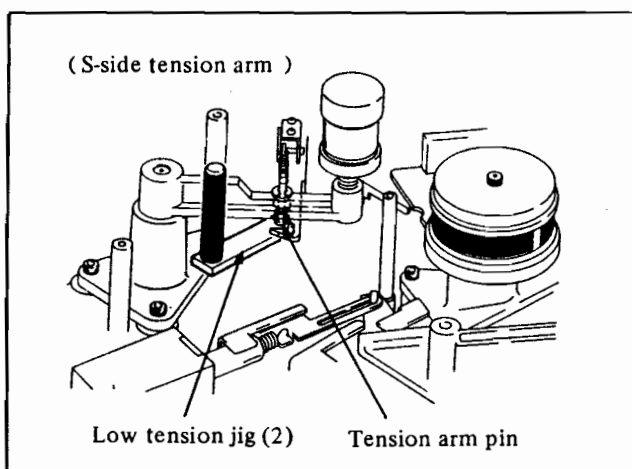
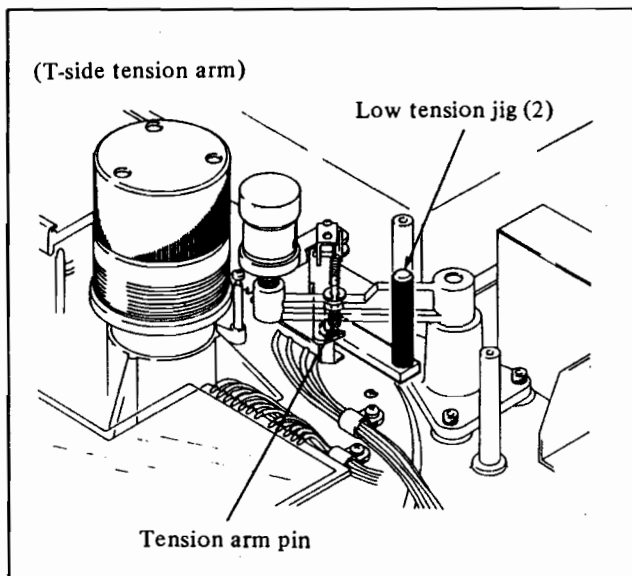
1. Turn the power off.
2. Use the extension board to access the SRVO board. Attach low-tension jig (1) to SRVO board IC35 with the LED facing upward, and slip the jig flush against pin 20.



3. Turn the SRVO board TEN SRV and TEN DA switches off.
4. Unplug CCB board CN104 to release the END OF TAPE sensor.
5. Turn the power back on.

Adjustment

- Press the tension disarm button. Slide the hole on low-tension jig (2) onto the pin on the tension arm after the tension arm has retracted.



- Adjust VR108 (VR109 for the S-side) on the SRVO board so that the LED on the low tension jig (1) corresponding to the reel being adjusted*, illuminates when the low tension jig (2) is attached, and goes out when the low tension jig (2) is detached.

* Green LED = T-side, yellow LED = S-side.

(3) Confirmation

- Confirm that load mode is released when the low-tension jig (2) is detached in the loading mode.
- Conduct steps 1 to 5 of the foregoing section, (2) Adjusting low-tension detection (SRVO board), in reverse sequence to return all components to their normal condition.

5.7.3 Adjusting Tape Tension

Conduct the adjustments as indicated in the table below according to work being carried out.

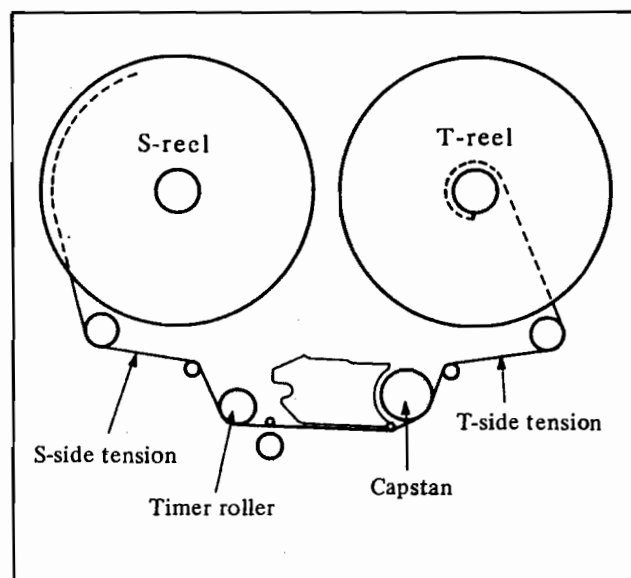
Work	Electrical O-adjustment and rough tension adjustment	Tension adjustment	Slip check
Tension arm replacement	○	○	○
SRVO board replacement	—	○	○
Periodic check	—	○	○

(1) Electrical O-adjustment

- Load a tape and put the machine in the loading-stop mode.
- Adjust the trimmer SH and TH on the SRVO board to obtain a reading of 0V 10mV at the respective corresponding test points.

Trimmer	Test point	
	+	—
SH	TP105	TP108
TH	TP101	TP104

(2) Rough adjustment of tension

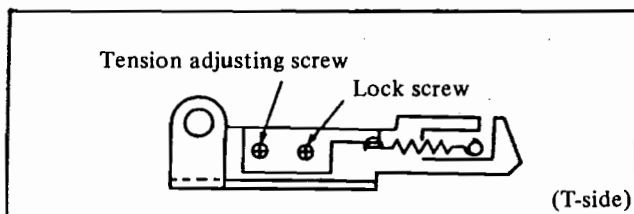


S-side tension (SH) adjustment

Loosen the lock screw and adjust the tension adjusting screw to obtain an S-side tension of 200 20g. Retighten the lock screw.

T-side tension (TH) adjustment

Loosen the lock screw and adjust the tension adjusting screw to obtain an S-side tension of 200 20g. Retighten the lock screw.



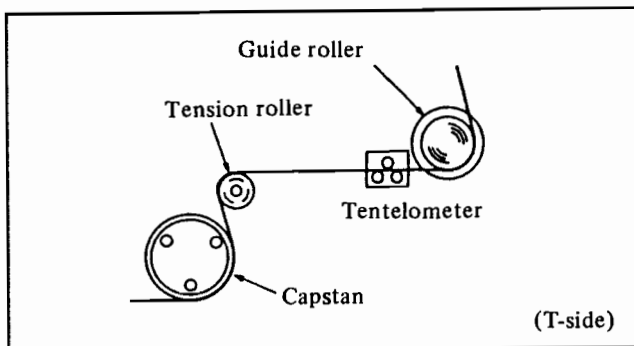
(3) Fine adjustment of tension

STOP tension (SH & TH) adjustment

1. Run the tape in forward and rewind until tape speed stabilizes, then stop and measure tape tension in the STOP mode (see diagram below).
2. Adjust, on the SRVO board, the SH trimmer (for S-side tension) and the TH trimmer (for T-side tension) to get tension of 200 20g on each side.

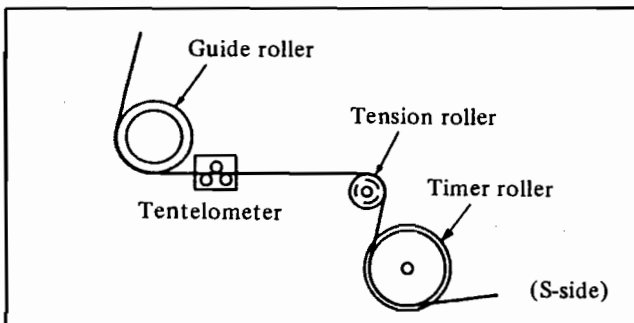
REW (reverse) tension (TL) adjustment

1. Use the shuttle to slowly rewind the tape, at about the same speed of travel in the PLAY mode.
2. Adjust the T-side tension to 160 5g by means of the TL trimmer on the SRVO board.



FF (forward) tension (SL) adjustment

1. Use the shuttle to slowly advance the tape, at about the same speed of travel in the PLAY mode.
2. Adjust the S-side tension to 160 5g by means of the SL trimmer on the SRVO board.



PLAY tension (SF) adjustment

1. Load a blank tape and put the machine in the PLAY mode.
2. Adjust the SF trimmer on the SRVO board so that the wow and flutter observed at SRVO board TP401 becomes 0.015% (weighted, RMS, fc200Hz, secondary LPF) at 130 5g tension.

Note: Conduct the necessary capstan motor wow adjustments as directed at 6.1.1 5.

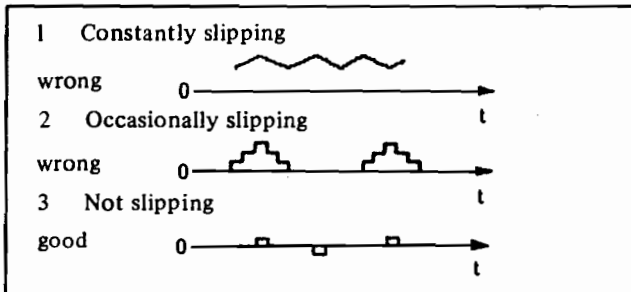
Mode	S-side tension		T-side tension	
	Point of adj.	Spec.	Point of adj.	Spec.
STOP	SH (RV103)	200g±5g	TH (RV101)	200g±5g
SHUTTLE REW			TL (RV102)	160g±5g
SHUTTLE FF	SL (RV104)	160g±5g		
PLAY	SF (RV105)	130g±5g		

Note: TH : Take-up/high
SH : Supply/high
TL : Take-up/low
SL : Supply/low
SF : Supply/forward

- The adjusting ranges of the above specifications become broader after conducting the procedures prescribed at 5.7.4, Checking Slip.

5.7.4 Checking Slip

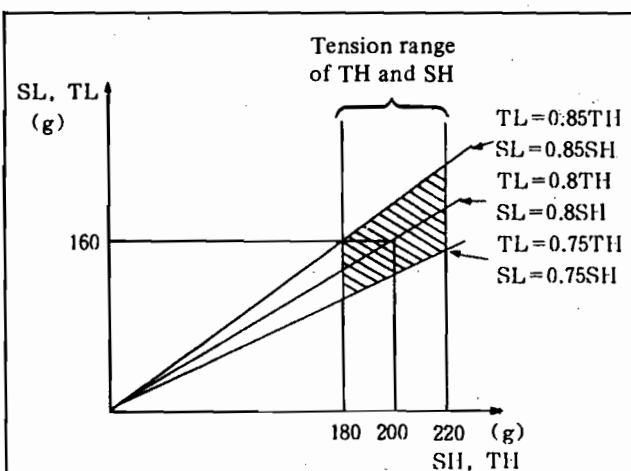
1. Connect an oscilloscope between TP1 (slip compensation servo signal) and GND on the SRVO board and check that the slip servo is not constantly locked during REW and FF operations.



2. The slip servo normally locks instantaneously two or three times, then returns to 0V during acceleration when rewinding with 10-inch or 14-inch reels (use of a 14-inch reel is preferable); example 3 (diagram, above) illustrates the normal signal. If a signal such as that in example 2 is obtained, increase or reduce the SL and TL within the target values given below, to achieve the proper signal.

If, after making the above adjustment, the slip servo locks more often than before, conduct the same adjustment again, this time turning the VRs in the opposite direction. Make adjustments so that a waveform like the one in example 3 is obtained when tape is rewound from beginning to end.

Specification: SH : $200 \pm 20g$
 TH : $200 \pm 20g$
 SL/TH : 0.80 ± 0.05
 TL/SH : 0.80 ± 0.05
 SF/TH : 0.65 ± 0.05



5.7.5 Replacing the Tension Roller Bearings

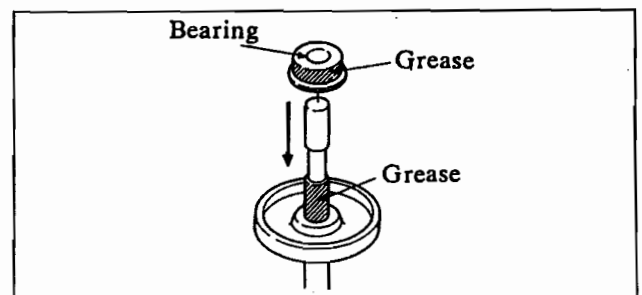
The procedure given below is for exchanging only the bearings of the tension rollers.

(1) When to replace

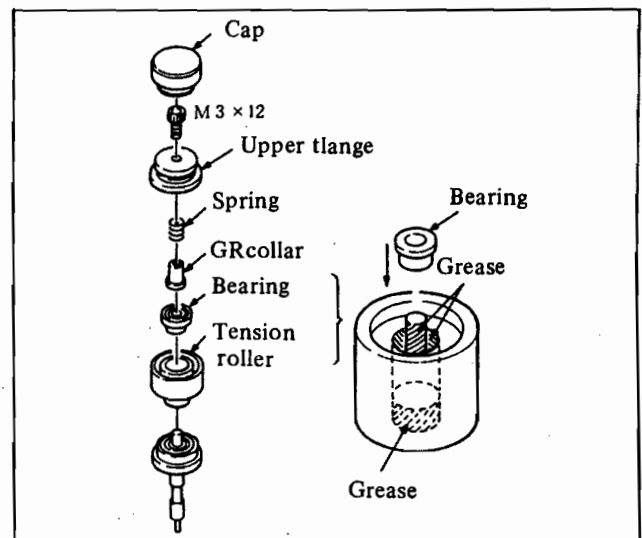
Replace the tension roller bearings when required by the periodic inspection schedule in Section 4.

(2) How to replace

1. Manually rotate and remove the tension roller cap, unfasten the M3 X 12 hexagonal socket-head screw, and remove the roller and bearings from the shaft.
2. Apply Sony SGL-501 grease to the areas of the lower bearing and shaft indicated by the diagonal lines in the illustration below, and place the bearing on the shaft.



3. Place the roller on the shaft.
4. Apply grease to the areas of the roller and the shaft indicated by the diagonal lines in the illustration below, and place the new upper bearing on the shaft.
5. Place the GR collar, the spring, and the upper flange on the shaft and secure the flange with the M3 X 12 hexagonal socket-head screw, and replace and tighten the cap.



6. Rotate the roller manually to check for abnormal noise.
7. Clean the roller.

(3) How to adjust

Adjust the repaired tension roller by conducting the checks and adjustments of tension roller level as directed in 5.3.3 and 5.3.5.

58 Replacing and Adjusting the Guide Rollers

581 Replacing the Guide Roller Assembly

(1) When to replace;

Replace the guide roller assembly when required by the periodic inspection schedule in Section 4.

(2) How to replace the guide roller assemblies

1. Unfasten the M4 X 12 hexagonal socket-head screws securing the guide roller assembly to be replaced.
2. Inspect the guide roller and flanges of the new guide roller assembly for damage, and manually rotate the roller to check for abnormal noises.
3. Place the new guide roller assembly on the chassis, insert roller positioning jigs into two of the screw holes, set one of the M4 X 12 hexagonal socket-head screws into the remaining hole, and tighten the screw.
4. Remove the positioning jigs, set the other two M4 X 12 hexagonal socket-head screw in the holes, and tighten the screws.
5. Clean the roller.

(3) How to adjust

- S-side guide roller adjustments

Conduct the check and adjustment of the S-side guide roller level as directed in 5.3.6, and the check and adjustment of the reel mount level as directed in 5.3.7.

- T-side guide roller adjustments

Conduct the check and adjustment of the T-side guide roller level as directed in 5.3.6, and the check and adjustment of the reel mount level as directed in 5.3.7.

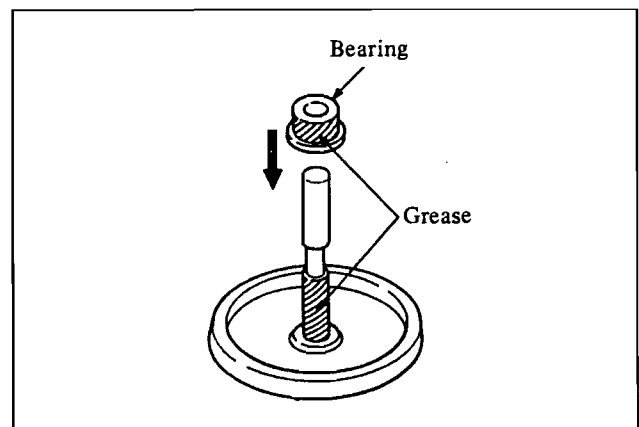
582 Replacing the Guide Roller Bearings

(1) When to replace

Replace the guide roller bearings when required by the periodic inspection schedule in Section 4.

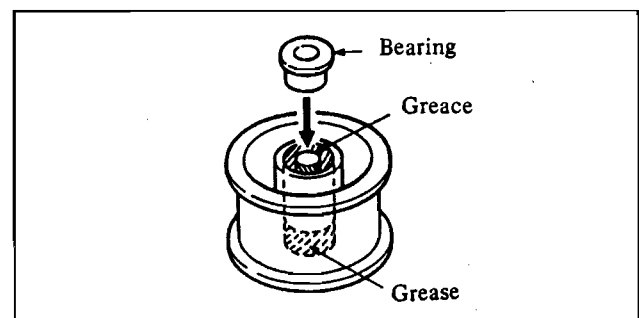
(2) How to replace

1. Manually rotate and remove the guide roller cap, unfasten the M3 X 12 hexagonal socket-head screw, and remove the roller and bearings from the shaft.
2. Apply Sony SGL-501 grease to the areas of the lower bearing and shaft indicated by the diagonal lines in the preceding illustration, and place the bearing on the shaft.



3. Place the roller on the shaft.

4. Apply grease to the areas of the roller and the shaft indicated by the diagonal lines in the illustration below, and place the new upper bearing on the shaft.



5. Place the GR collar, the spring, and the upper flange on the shaft and secure the flange with the M3 X 12 hexagonal socket-head screw, and replace and tighten the cap.
6. Rotate the roller manually to check for abnormal noise.
7. Clean the roller.

(3) How to adjust

Adjust the repaired guide roller by checking and adjusting the S-side and T-side guide roller levels as directed in 5.3.4 and 5.3.6.

5.9 Motor Assembly, Reel Motor, Brake Band and Brake Solenoid

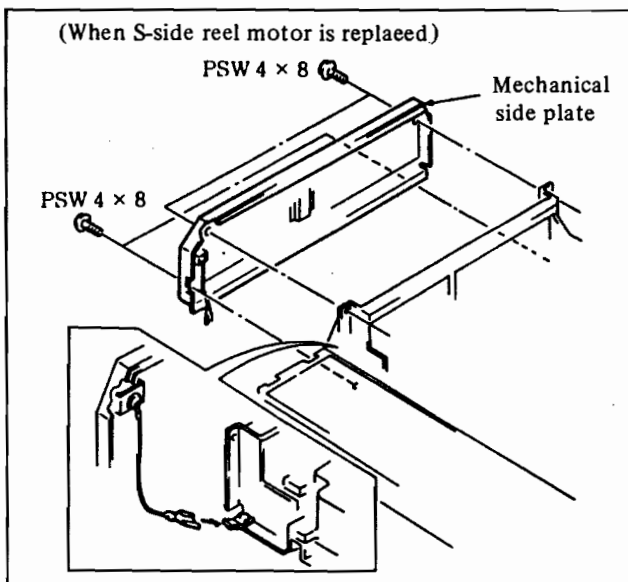
5.9.1 Replacing the Reel Motor Assembly

(1) When to replace

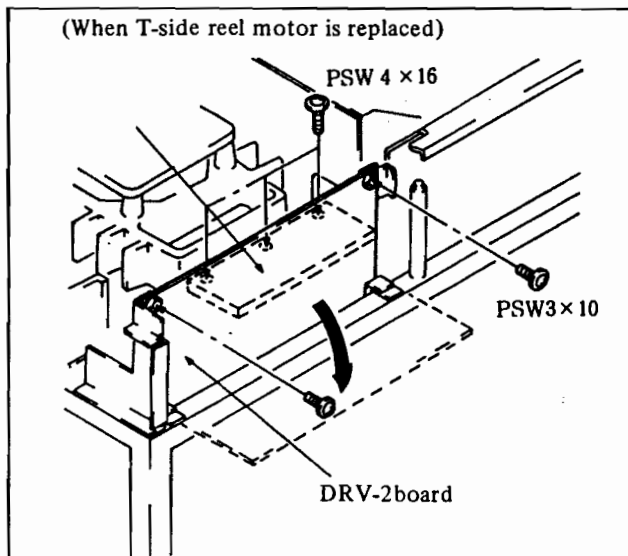
- Replace the reel motor assemblies when required by the periodic inspection schedule in Section 4.
- Replace the reel motor assemblies when they begin to generate abnormal noises.

(2) Primary preparations

1. Unfasten the PSW4 X 8 screws securing the head cover and remove the head cover by lifting it upward.
2. Remove the upper panel.
3. Remove the mechanism side plate as shown below.

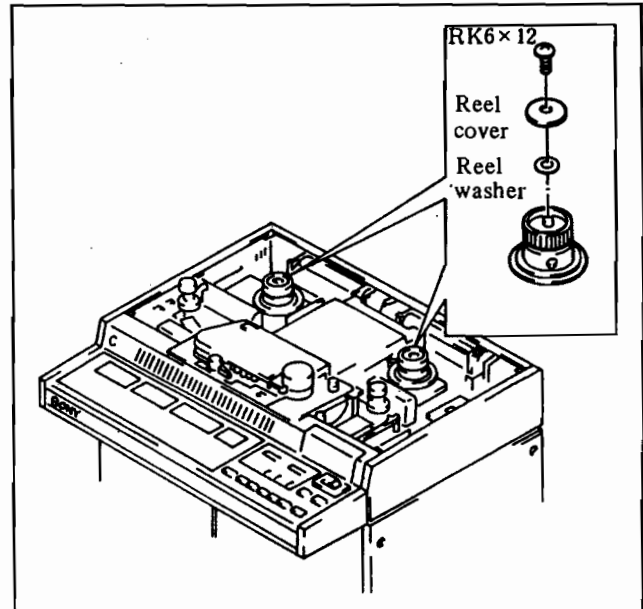


4. Unfasten and remove the three PSW4 X 16 screws securing the heat sink on the CRV-2 board (illustration below).
5. Remove the two PSW3 X 10 screws securing the DRV-2 board and open the board (it is attached to the frame with hinges; see the illustration below).

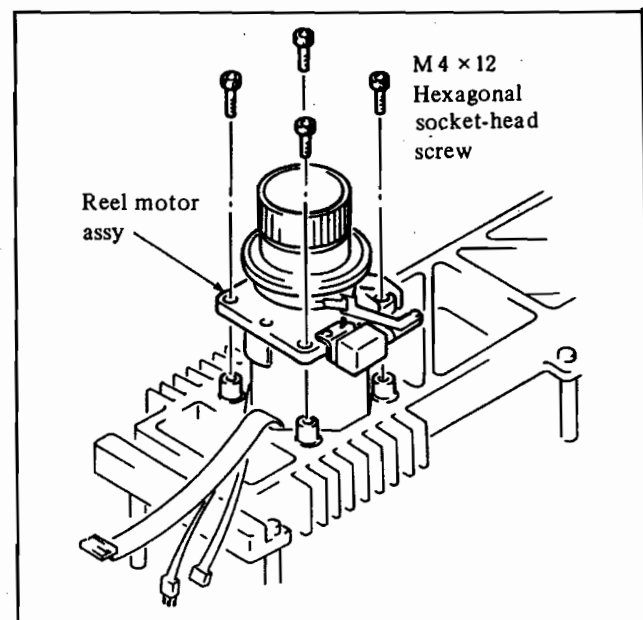


(3) How to replace

1. Unfasten the RK6 X 12 screw at the top of the reel mount and remove the screw, the reel-mount cover, and the washer under the cover (see diagram, below). Set the screw, cover, and washer aside in a safe place since they are to be used again after installation of the new reel motor assembly.



2. Disconnect the brake plunger leads from the PLD board.
3. Disconnect the three reel-motor harnesses from the DRV-2 board.
4. Unfasten the four M4 X 12 hexagonal socket-head screws and remove the old motor assembly (see diagram, below).



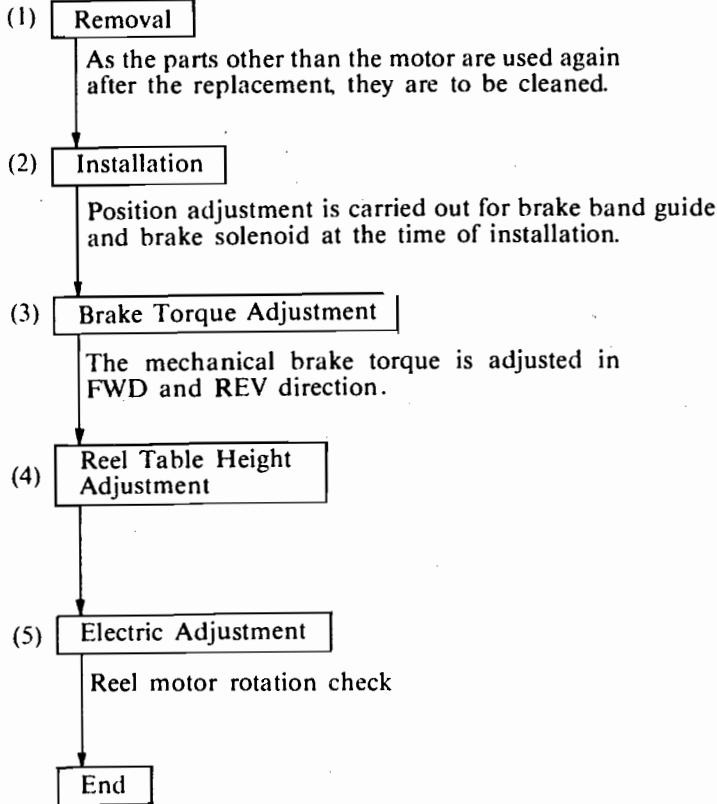
5. Install the new motor assembly, setting it so that the solenoid comes in front of the motor assembly when viewed from the front of the machine.
6. Insert roller positioning pins into two of the four screw holes in the base of the reel motor assembly, inserting them up to the tape holes in the reel chassis, to properly position the reel motor assembly.
7. Set two of the M4 X 12 hexagonal socket-head screws in the remaining holes and tighten them.
8. Remove the positioning pins, set the other two screws in the open holes, and tighten the screws to secure the assembly to the chassis.
9. Connect the reel motor assembly harnesses to their respective connectors and return the DRV-2 board to its original position.

(4) How to adjust and confirm proper operation

1. Check and adjust as necessary the reel mount level as directed in 5.3.7.
2. Check and adjust as necessary the braking torque as directed in Section 5.10.2.
3. Set the washer and the reel-mount cover (removed in step 1 of (3) "How to replace") into place on the reel motor assembly and secure them with the RK6 X 12 screw.

5.9.2 Replacing the Reel Motor

Perform the replacement and the subsequent adjustment as follows.

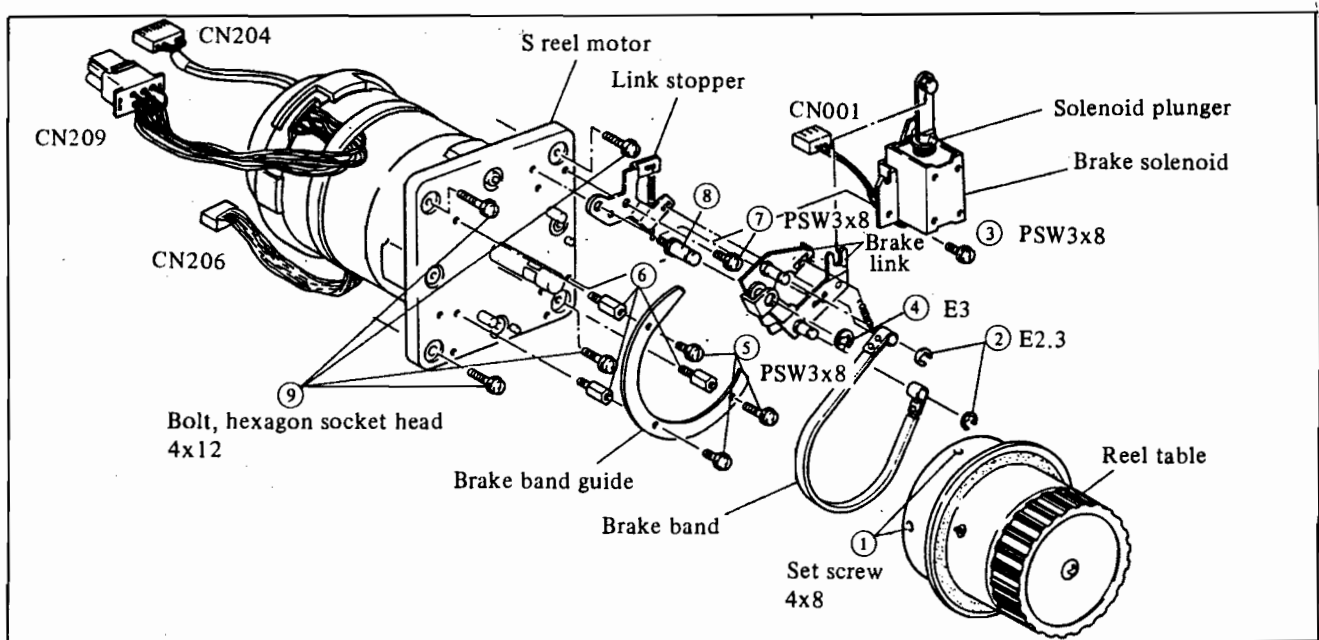


(1) Removal

1. Remove reel motor ASSY referring to "5.9.1. Replacing the Reel Motor Assembly."
2. Loosen the two set screws ① shown the figure below. While pushing the solenoid plunger by hand pull out the reel table.
3. Remove the two E rings ②, and remove the brake band.
4. Remove the screw ③, and remove the brake solenoid assembly.
5. Remove each one end of the two springs applied between link stopper and brake links. Remove the E ring ④, and remove the brake links.
6. Remove the three screws ⑤, and remove the brake band guide.
7. Remove the three brake band posts ⑥.
8. Remove the set screw ⑦ and the brake post ⑧ securing the link stopper.
9. Remove the four screws ⑨, and remove the S reel motor.
10. Clean the surfaces of the bosses from which the motor has been removed and the removed parts.

Note: Take sufficient care not to bend the brake band.

Note: Prepare the following tool for adjustment
Reel brake band guide adjustment jig (J-6103-340-A)

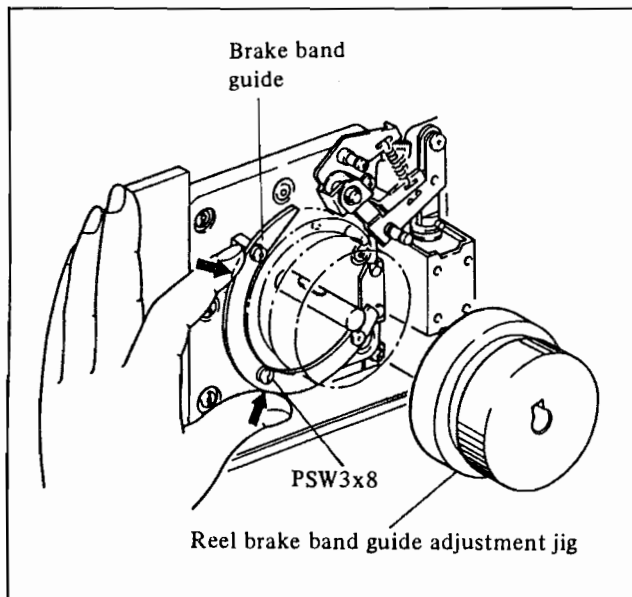


(2) Installation

1. Fix new reel motor to chassis of units with four screws ⑨ (BOLT 4 × 12, HEXAGON SOCKET HEAD), and position the harness as before.
2. Fix link stopper with brake support ⑧, then tighten it with screw ⑦ (PSW3 × 8).
3. Attach three brake band supports ⑥.
4. Arrange two brake links as shown in the figure of step "(1) Removal", then insert it to brake support, and fix it with E ring ④ (E3).
5. Fix spring between link stopper and brake link.
6. Fix brake solenoid with screw ③.

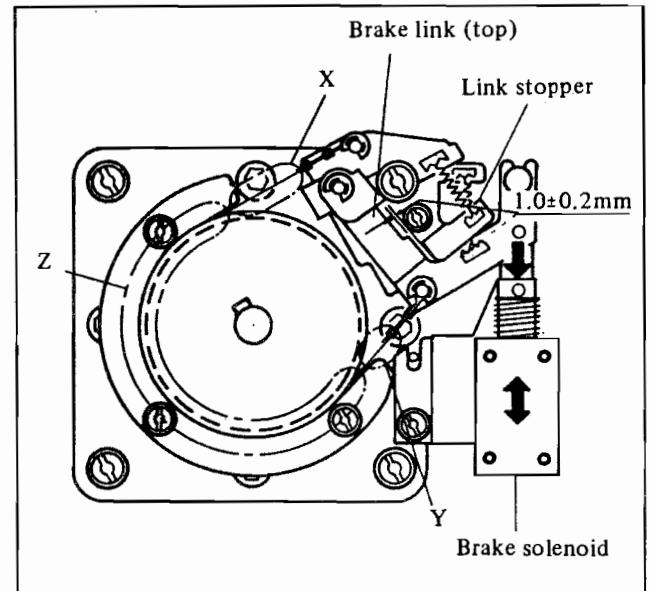
Brake Band Guide Position Adjustment

7. Attach brake adjustment fixture to reel motor shaft as shown the figure below.
8. While pressing the brake band guide lightly against the brake adjustment fixture, fix the brake band guide with the three PSW3 × 8 screws.
9. Remove the brake adjustment fixture.



Brake Solenoid Position Adjustment

10. When the plunger has been pressed, adjust the position of the brake solenoid so that the brake band is not transformed at the "X" and "Y" locations shown the figure below, and it is along brake band guide closely all along the "Z" location. After the adjustment, fix the brake solenoid with a PSW3 × 8 screw.



Link Stopper Position Adjustment

11. Clean the lower cylinder of the reel table (the surface coming in contact with the brake band) and while pressing the plunger by hand, place the reel table onto the reel motor shaft.
12. Do not push the plunger and adjust the position of the link stopper so that the clearance between the link stopper and the brake link (top) is the value shown in the above figure.
13. While pushing reel table lightly to the reel motor, fix it with two set screws.

(3) Brake Torque Adjustment

Adjust mechanical brake torque according to Operation and Maintenance Manual "5-10. Adjusting the Braking Torque".

(4) Reel Table Height Adjustment

Confirm height of reel table according to Operation and Maintenance Manual "5-3-7. Checking and Adjusting the Reel Table Height".

(5) Electrical Adjustment

Confirm turn of reel motor according to Operation and Maintenance Manual "6-1-3. DRV-2 Board Adjustment".

5.9.3 Replacing the Brake Band

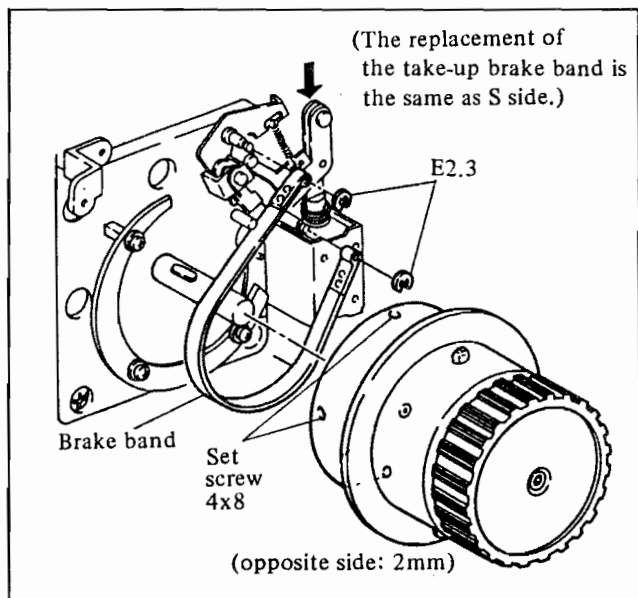
Preliminary Information

When the mechanical brake torque can not be adjusted with any application position of the adjustment spring, the brake band must be replaced. Brake band replacement and the subsequent adjustment after the replacement are carried out according to the following sequence.

- (1) Removal
- ↓
- (2) Installation
- ↓
- (3) Brake Torque Adjustment
- ↓
- (4) Reel Table Height Confirmation
- ↓
- End

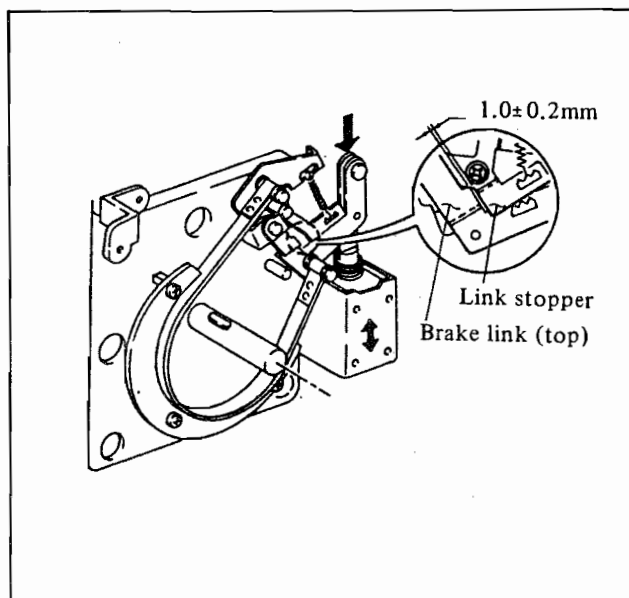
(1) Removal

1. Loosen the two set screws shown in the figure below. While attracting the solenoid plunger, remove the reel table. Clean the cylindrical part at the lower part of the reel table, which has been in contact with the brake band.
2. Remove the two E rings, and remove the brake band.



(2) Installation

1. Install the new brake band in the position shown in the figure below, and fasten it with the two E rings (E2.3).
2. While pressing the plunger, insert reel table into reel motor shaft as shown in the figure of "(1) Removal."
3. While not pressing the plunger, check that the clearance between the link stopper and the brake link (top) is 1.0 ± 0.2 mm. If it is not within specifications, adjust the position of the link stopper.
4. While pushing the reel table to the reel motor, tighten the two set screws.



(3) Brake Torque Adjustment

Adjust mechanical brake torque according to "5-10. Adjusting the Braking Torque".

(4) Reel Table Height Confirmation

Adjust the reel table height referring to "5.3.7 Checking and Adjusting the Reel Table Height".

5.9.4 Replacing the Brake Solenoid

Preliminary Information

Brake solenoid replacement is carried out in the following sequence.

- (1) Removal
- (2) Installation
- (3) Solenoid Assembly Position Adjustment
- (4) Brake Torque Adjustment
- (5) Reel Table Height confirmation
- End

(1) Removal

1. Loosen the two set screws securing the reel table. Next, while attracting the solenoid plunger by hand, pull the reel table.
2. Remove one screw (PSW3 × 8) shown in the figure below to remove the brake solenoid assembly and disassemble the brake solenoid assembly.

(2) Installation

1. Replace the solenoid for a new one and reassemble. At this time, install the bracket so that it can be moved lightly.
2. Adjust so that the distance between the solenoid pin and the end of the longitudinal hole of the bracket becomes $5.0\text{ mm} \pm 0.5\text{ mm}$ as shown in the figure below, and then fix the bracket securely.
3. Lightly fix the solenoid assembly with one screw (PSW3 × 8) in the position shown in the figure below.

(3) Solenoid Assembly Position Adjustment

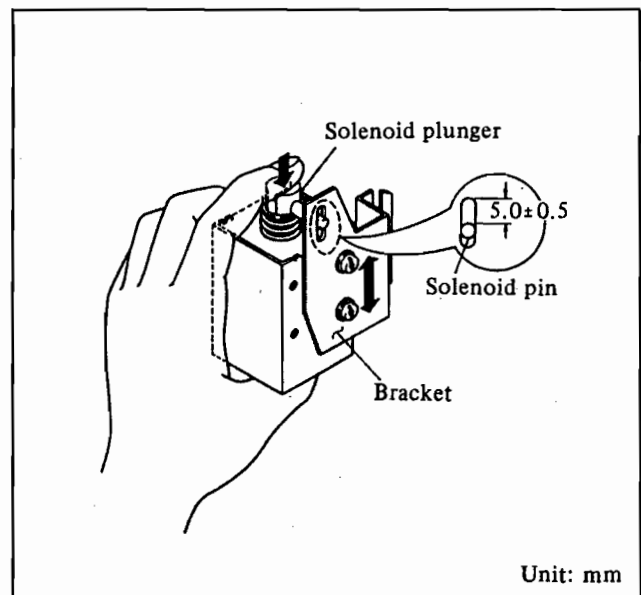
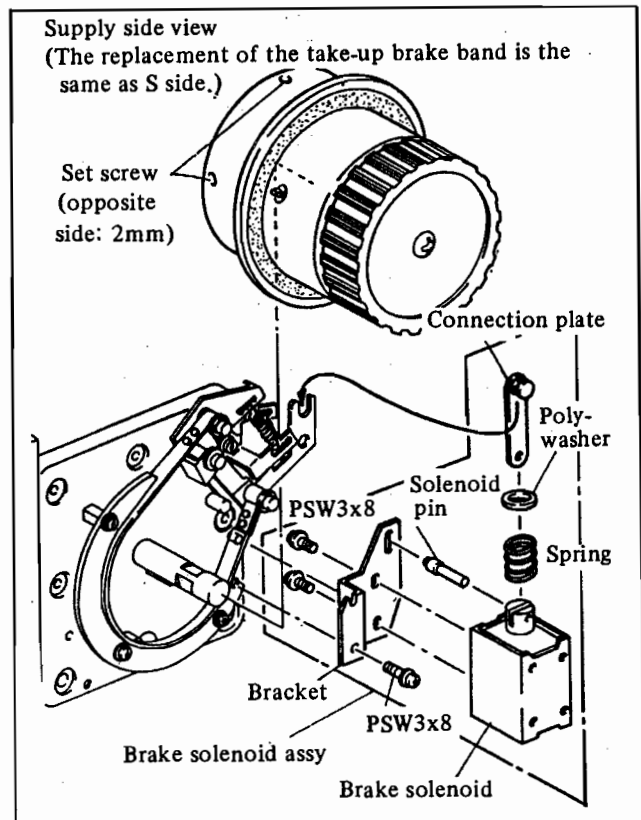
1. Adjust referring to "Brake Solenoid Position Adjustment" of (2) Installation in "5.9.2 Replacing the Reel Motor".
2. While pushing the reel table to the reel motor, tighten two set screws.

(4) Brake Torque Adjustment

Check the brake torque referring to "(3) Brake Torque Adjustment" in "5.9.2 Replacing the Reel Motor".

(5) Reel Table Height Confirmation

Check the reel table height referring to "(4) Reel Table Height Adjustment" in "5.9.2 Replacing the Reel Motor".



5.10 Adjusting the Braking Torque

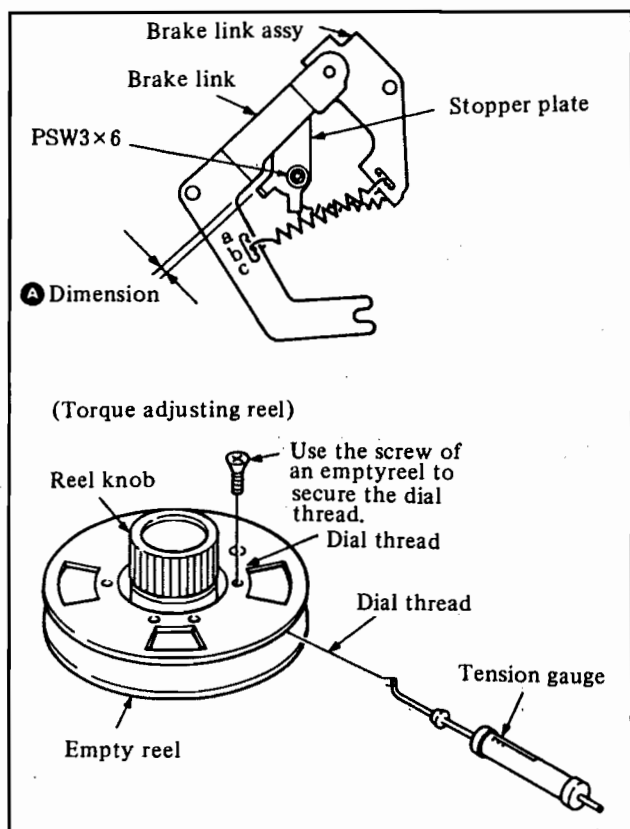
Checking the braking torque

1. Construct a torque adjusting reel by attaching one end of a dial thread to an empty reel and the other end, to a tension gauge, as shown in the illustration below; and set the reel on the reel mount to be checked.
2. Target values: Winding-out torque = max. 50g, winding-in torque = 300 – 400g.

Adjusting the braking torque

Use the torque adjusting reel constructed at step 1, above (also refer to the illustration, below).

1. If the winding-out torque exceeds 50g, change the position of the spring from notch b to notch a; if the winding-in torque is less than 300g, change the position of the spring from notch b to notch c.
2. If the situation cannot be corrected by the method explained in step 1, loosen the PSW3 X 6 screw and adjust by moving the stopper plate: When the winding-in torque is less than 300g, open the gap marked **A** in the diagram below; when the winding-in torque exceeds 400g, close the gap. The ideal dimension of gap **A** is 1 – 1.5mm.



5.11 Replacing the Capstan Motor

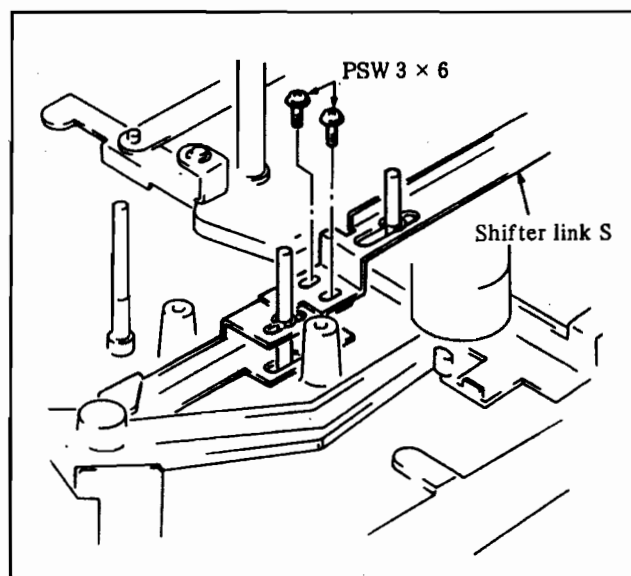
5.11.1 Replacing the Capstan Motor

(1) When to replace

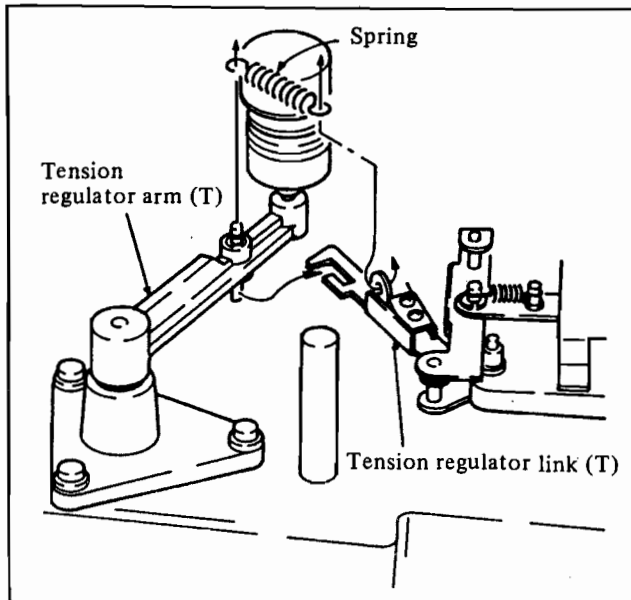
- Replace the capstan motor when required by the periodic inspection schedule in Section 4.
- Replace the capstan motor whenever any of the following abnormalities occurs:
 - * The capstan begins to generate abnormal noises.
 - * The surface of the capstan becomes damaged (scratches, etc.). Note, however, that minor scratches can sometimes be removed from the capstan by polishing; contact your Sony service representative for advice in such cases.

(2) How to replace

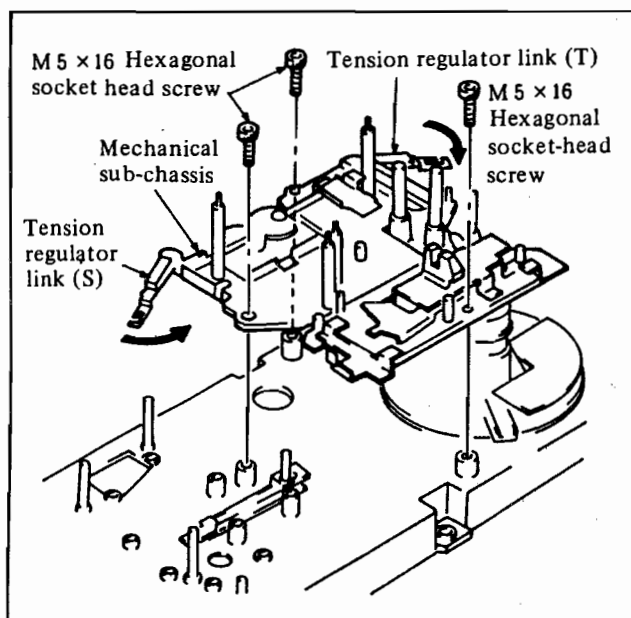
1. Turn the power on, cover the tape sensor with your finger, and press the tension disarm switch. Turn the power off when as soon as the tension regulator fully retracts.
2. Remove the head cover, the upper panel, and the control panel, then tilt the meter panel forward and remove transport tables A, B, and C (this procedure is described in Section 3).
3. Remove the shield tray and disconnect all head connectors, then remove the head block unit (see 5.12.2 for details).
4. As illustrated below, remove the two PSW3 X 6 screws that connect shifter link M to the link below it.



5. As illustrated below, remove the spring hooked to the tension regulator arm and the tension regulator link, then remove the arm and the link. Conduct this procedure on both the T- and S-sides.

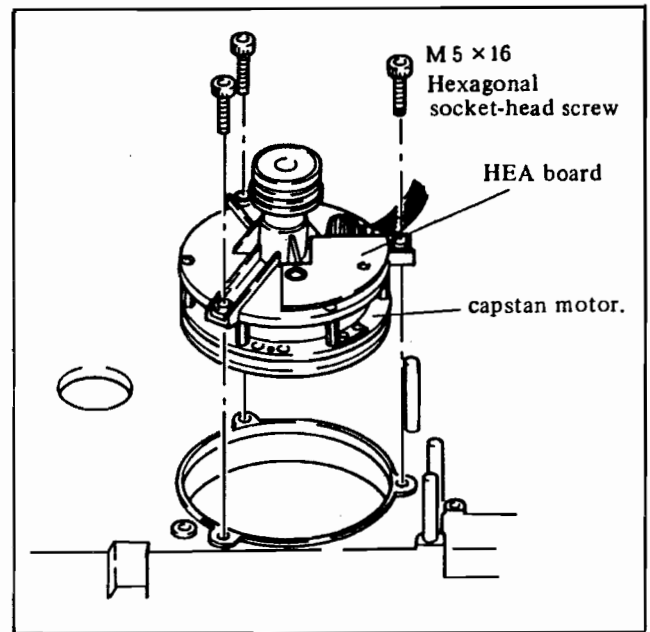


6. Disconnect the tension disarm switch harness and the tape sensor harness from the CCB board.
7. Unfasten the three M5 X 16 hexagonal socket-head screws and lift the mechanism sub-chassis upward to remove it.



Note: Before re-installing the sub-chassis, set the tension regulator links against the sides of the sub-chassis as indicated by the arrows in the illustration above.

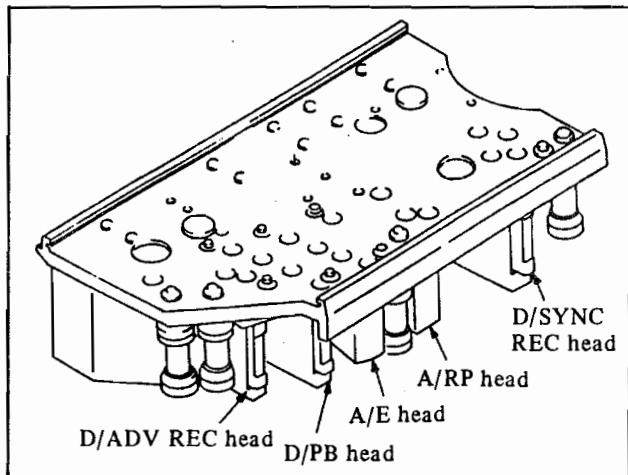
8. Set the removed mechanism sub-chassis on top of the preamp case.
9. Disconnect the three capstan motor harnesses from the DRV-1 and CCB boards.
10. Unfasten the three M5 X 16 hexagonal socket-head screws securing the capstan motor and remove the motor by lifting it upward.



11. Set the new capstan motor into place, positioning it so the HEA board is situated at the right front.
12. Set roller positioning pins in two of the holes for securing the capstan motor, set one of the hexagonal socket-head screws in the remaining hole, and tighten the screw.
13. Remove the positioning pins, set the other two screws in the open holes, and tighten the screws to secure the capstan motor to the sub-chassis.
14. Conduct steps 9 to 13 in reverse sequence to re-install the mechanism sub-chassis to the unit; use the roller positioning pins to properly position the sub-chassis before securing it to the main chassis.
15. Re-install the head block unit and re-connect the head connectors previously disconnected at step 3.
16. Adjust the HEA board as directed in Section 6.12.
17. Check and adjust the tape transport system as directed in Section 5.3.
18. Remove the knob and face plate from the old capstan motor and install them on the new motor.
19. Re-install transport tables A, B, and C; the control panel; the upper panel; and the head cover, removed at step 2.

5.12 Replacing and Adjusting the Head Block Unit (HBU)

5.12.1 Description of the HBU



The following five heads comprise the head block unit (HBU) of the PCM-3324:

- 2 digital recording heads (D/REC)
- 1 digital playback head (D/PB)
- 1 analog recording/playback head (A/RP)
- 1 analog erasing head (A/E).

These heads must be replaced and adjusted when they have become excessively worn or damaged. Replacement is conducted according to either of the following methods:

1. Replacement of the HBU

Since all of the heads generally wear uniformly under normal-use conditions, the head block unit is exchanged as a unit when the heads have become worn.

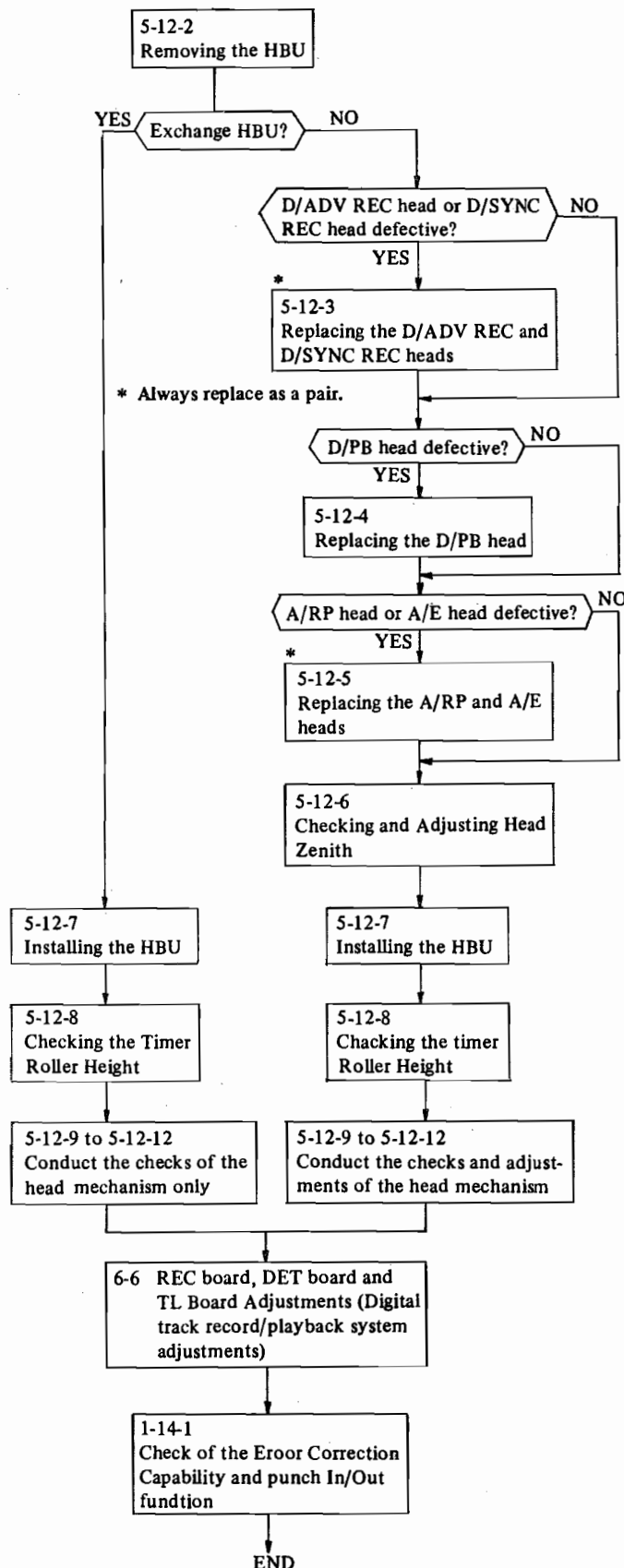
2. Replacement of individual head assemblies

Head assemblies are generally replaced individually only when a head has been damaged.

Replacement of the HBU as a unit can be completed in a relatively short time, and adjustment of the head mechanism is as a rule unnecessary. The decision as to whether to replace the HBU or a single head assembly should be made on the basis of how worn the unit is; in cases where all heads are relatively worn, it is advisable to replace the whole unit in lieu of just the damaged head assembly.

Removal of the HBU as directed in 5.12.2

Exchange HBUs? NO: <D/ADV REC head or D/SYNC REC head defective?> [Replace D/SYNC REC and D/SYNC REC heads are directed in 5.12.3] <D/PB head defective?> [Replace D/PB head as directed in 5.12.4] <A/RP head or A/E head defective?> [Replace A/RP and A/E head as



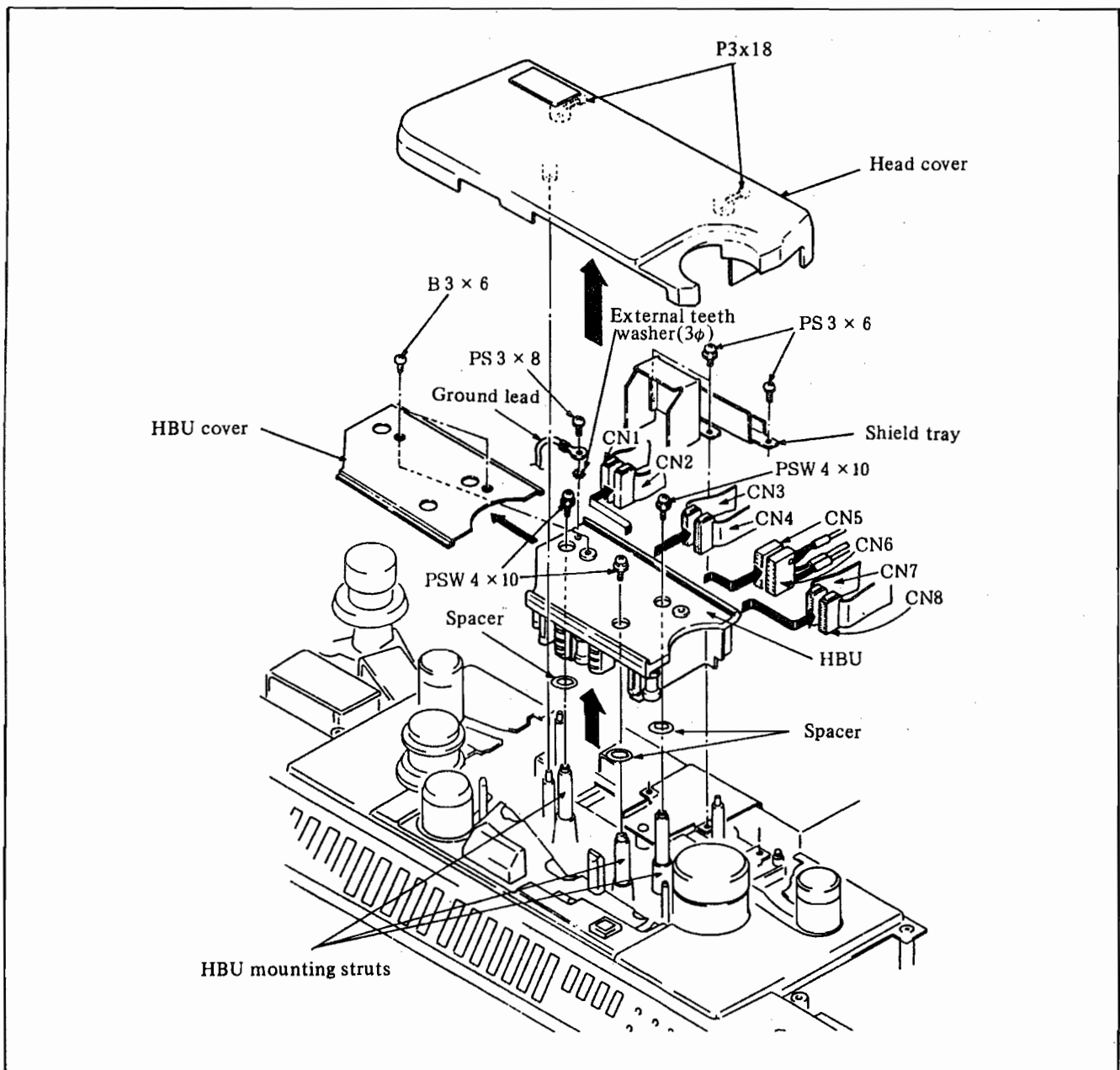
Head replacement procedure flowchart

5.122 Removing the HBU

1. Unfasten the two P3 X 18 screws and remove the head cover.
2. Unfasten the two B3 X 6 screws and remove the head base cover.
3. Disconnect connectors CN1, CN2, CN7, and CN8.
4. Unfasten the three PS3 X 6 screws and remove the shield tray.
5. Remove the PS3 X 8 screw, the toothed washer (3), and the ground lead.
6. Disconnect connectors CN3, CN4, CN5, and CN6.
7. Unfasten the three PSW4 X 10 screws and remove the HBU.

Important note:

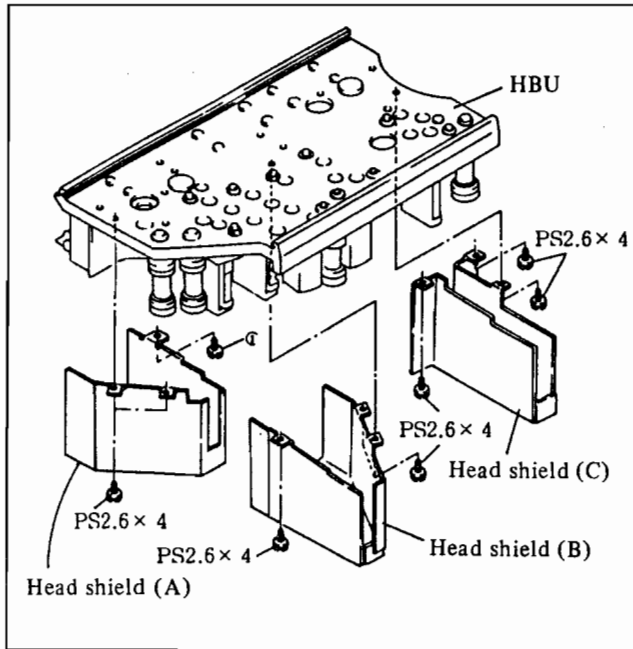
On some units, spacers have been placed on the HBU mounting struts for better precision. When exchanging HBUs, leave the spacers on the struts, or place them back on the struts in their original positions before installing a new HBU, to ensure accurate positioning of the unit. In order to avoid losing the spacers, it is advisable to place them back on their struts and temporarily secure them with the screws immediately after removing the old HBU. Also, check the back of the old HBU upon removal, as the spacers sometimes stick to the HBU frame instead of remaining on the mounting strut. Be sure to place any such spacers onto the strut from which they came.



5.123 Replacing the D/ADV REC and D/SYNC REC Heads

The D/ADV REC and D/SYNC REC heads must be replaced as a pair in order to ensure that electromagnetic conversion characteristics are maintained.

1. Remove the head shields (A), (B), (C).
- ① Unfasten the nine PS2.6 X 4 screws and remove the head shields (A), (B), and (C).

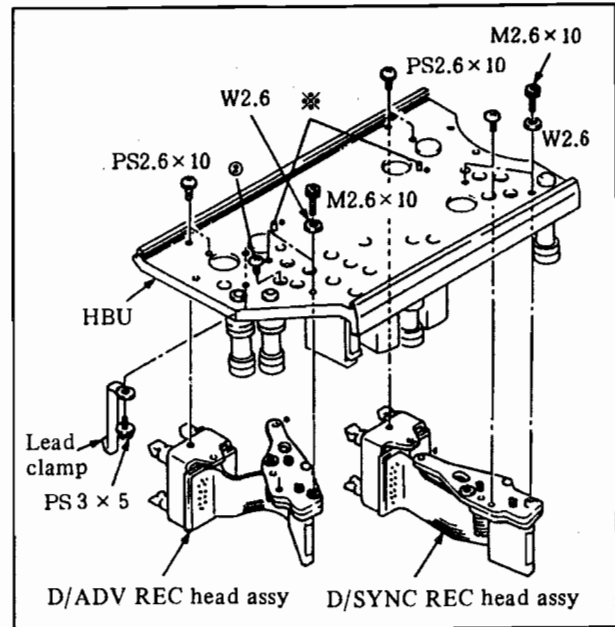


2. Remove the D/ADV REC and D/SYNC REC heads.

- ① Unfasten the PS3 X 5 screw and remove the lead retainers.
- ② Remove the four PS2.6 X 10 screws.
- ③ Remove the four M2.6 X 10 hexagonal socket-head screws and the four 2.6 washers, and remove the D/ADV REC and D/SYNC REC head assemblies.

Note: Completely clean off any screw-lock that may be adhering to the back of the HBU base.

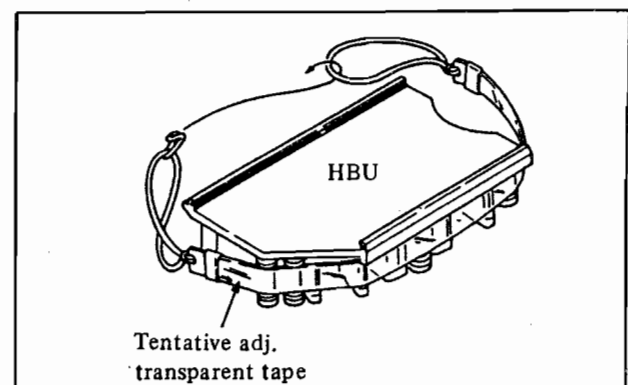
3. Align the pins on the head base with the holes in the adjusting plates (locations marked with the asterisks (*) in the following illustration) and tentatively secure the D/ADV REC and D/SYNC REC heads.



4. Tentatively adjust the head spacing of the D/ADV REC and D/SYNC REC heads.

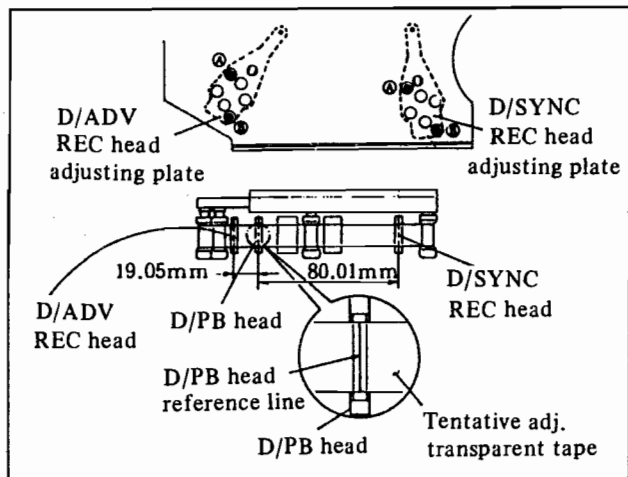
Adjustment procedure

1. Set the transparent tape for tentative head azimuth adjustments (jig # J-19) onto the HBU's tape guides as below.
- Transparent tape for tentative head azimuth adjustments (jig # J-19)



2. Align the D/PB head reference line with the center of the D/PB head (see the next diagram).
3. Loosen the D/ADV REC and D/SYNC REC head adjusting plate setscrews (A) and (B) (see the next diagram).

4. Tap the head adjusting plates lightly to align the centers of the heads with their respective reference lines on the transparent tape. When the heads are properly aligned, tighten setscrews (A) and (B).
5. Re-install head shields (A), (B), and (C).



5.124 Replacing the D/PB Head

1. Remove the D/PB head.

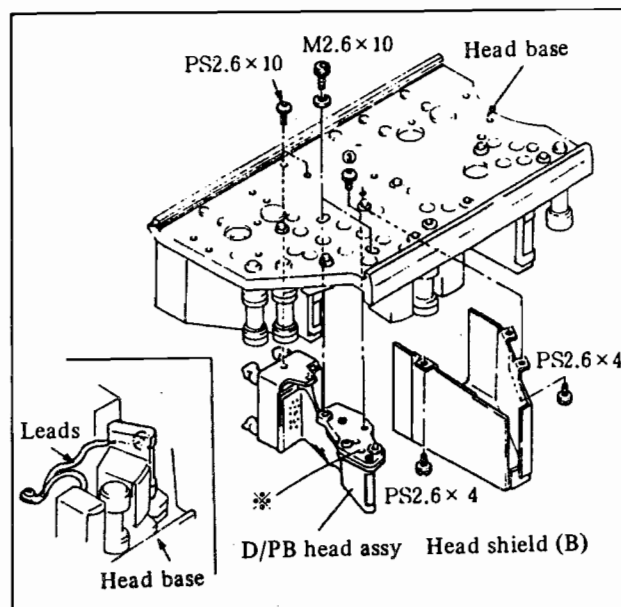
- ① Unsolder the lead wires from the D/PB head shield case (see diagram, below).
- ② Unfasten the three PS2.6 X 4 screws and remove head shield (B).
- ③ Unfasten the two PS2.6 X 10 screws.
- ④ Remove the two PS2.6 X 10 hexagonal socket-head screws and the two 2.6 washers, and remove the D/PB head assembly.

Note: Completely clean off any screw-lock that may be adhering to the back of the HBU base.

2. Align the pins on the head base with the hole in the head adjusting plate (marked with the asterisk (*) in the following illustration) and secure the D/PB head by tightening the hexagonal socket-head screw at 8kg/cm torque. Solder the lead wires in place.

Note: When soldering the lead wires, be careful not to expose the shield case to any more heat than necessary.

3. Re-install head shield (B).



5.125 Replacing the A/RP and A/E Heads

The A/RP and A/E heads must be replaced as a pair because they share common connectors.

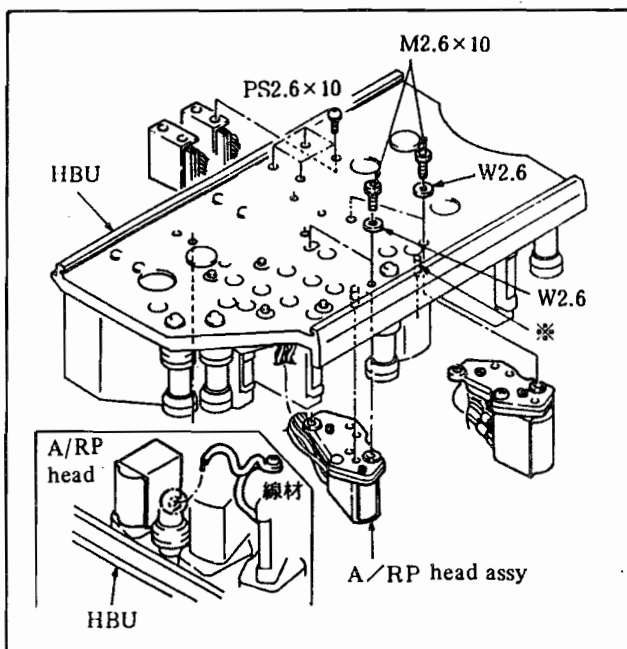
1. Remove the A/RP and A/E head assemblies.

① Unsolder the leads from the A/RP head shield case (see diagram, below).

② Remove the four PS2.6 X 10 screws, the four M2.6 X 10, and the four W2.6 washers, and remove the A/RP and A/E head assemblies.

Note: Completely clean off any screw-lock that may be adhering to the back of the HBU base.

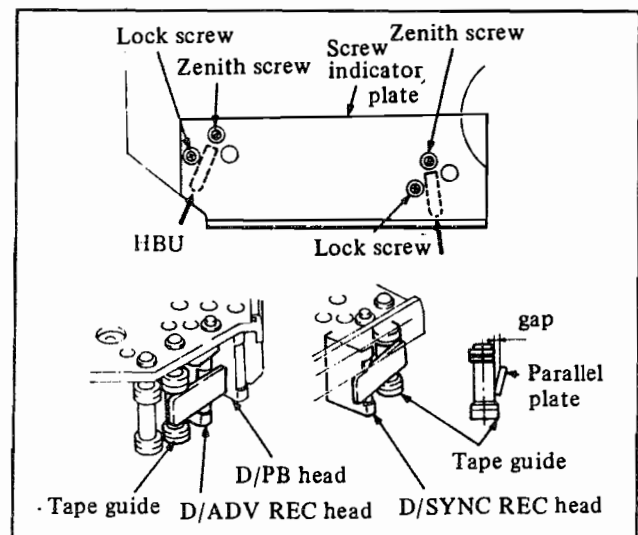
2. Align the pins on the head base with the holes in the head adjusting plates (marked with the asterisks (*) in the following illustration) and secure the new A/RP and A/E head assemblies by tightening the hexagonal socket-head screw at 8kg/cm torque.



5.126 Checking and Adjusting Head Slant

Checking Head Slant

1. Press the parallel plate (jig #J20) against the heads from the direction indicated by the arrows (see diagram, below) so as not to damage the heads.
2. As shown in the diagram, check that there is no gap between the parallel plate and the tape guides, taking the tape guides as reference; however, in the case of the D/PB head, use the adjacent head as a reference.



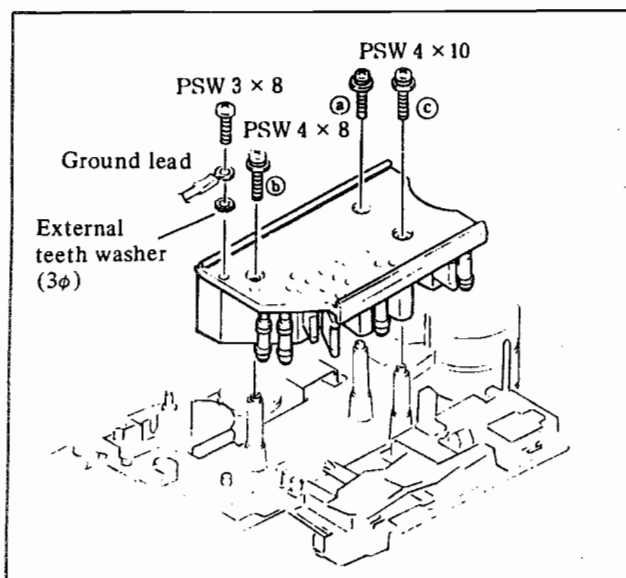
Adjusting Head Slant

Adjustment is necessary when there is a gap between the parallel plate and either the head or the tape guide. To adjust the head slant, loosen the lock screw corresponding to the head to be adjusted, and rotate the corresponding slant-adjusting screw to eliminate the gap. Note that there are no lock screws for the A/RP and A/E heads.

5127 Installing the HBU

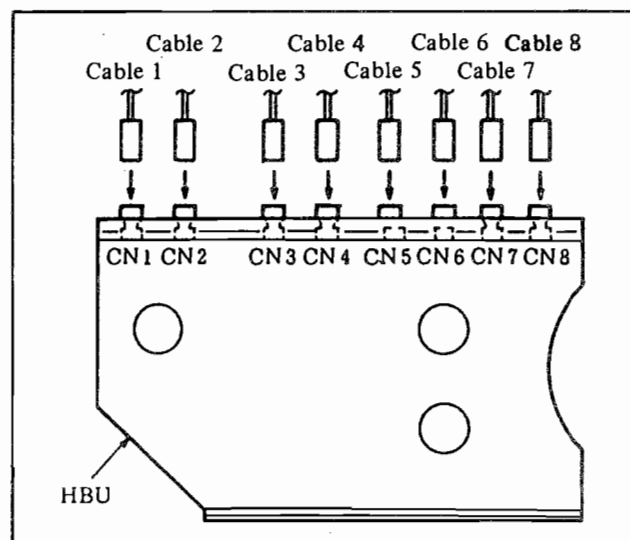
Install the reassembled, or the new, HBU as directed below.

1. Set the HBU onto the mounting struts on the head base. Be sure that any spacers are back in their original places, on the same struts as before the HBU was removed. Tighten the three PSW4 X 10 screws at 16kg/cm torque, in the sequence (a), (b), (c), with the torque limiter-equipped screwdriver (jig # J13) (see the diagram).
2. Re-install the ground lead to the HBU with the PSW3 X 8 screw and the toothed 3 washer (see the diagram).



Lastly, connect the head input/output cables to the respective connectors on the HBU (see diagram, below), and re-install the shield tray, the head base cover, and the head cover in their original positions.

In the subsequent sections, the level of the timer roller and the head mechanism are to be checked and adjusted. Be sure to connect and disconnect cables and assemble components in strict accordance with the instructions of the following sections.

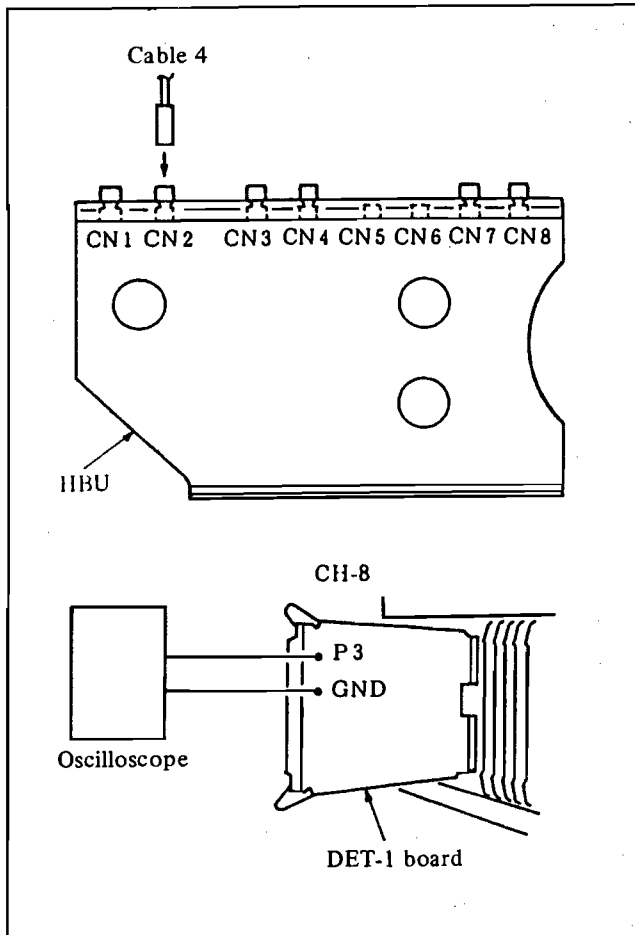


Connector/Cable	Corresponding head
CN1/Cable 1	D/ADV REC (odd-numbered channels)
CN2/Cable 2	D/ADV REC (even numbered channels & CTL)
CN3/Cable 3	D/PB (odd-numbered channels)
CN4/Cable 4	D/PB (even-numbered channels & CTL)
CN5/Cable 5	A/E, A/RP
CN6/Cable 6	A/E
CN7/Cable 7	D/SYNC REC (odd-numbered channels)
CN8/Cable 8	D/SYNC REC (numbered channels & CTL)

Name of connectors/cables and their corresponding heads

5.128 Checking the Timer Roller Level

1. Remove the playback shield case covering CN3 and CN4 of the HBU. Unplug cable 2 from connector CN2 (D/ADV REC head). Unplug cable 4 from connector CN4 (D/PB head) and plug it into CN2 so that the even-numbered channels can be played back.
2. Access the DET-1 board via the extension board and observe P3 (CH8) on an oscilloscope.

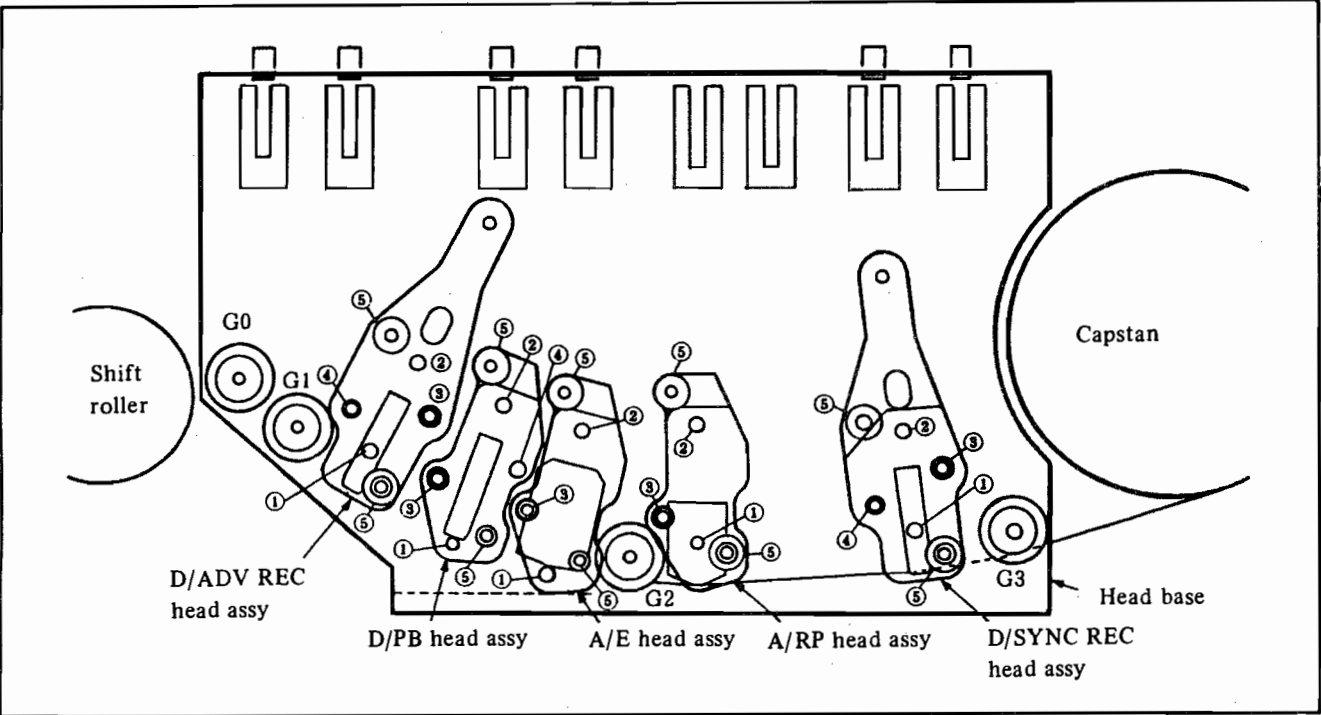


3. Play the tape transport standard tape (Sony-made).
4. Lift the upper flange of tape guide G1 (the second one from the left inside the HBU, see the diagram at 5-3-8) upward with your finger. If the playback output reading at P3 is half or more of what it was before lifting the flange, no adjustment is necessary. Also, check to be sure that the bottom edge of the tape is not curling near the lower guide flange.

If the output reading is less than half what it was before the flange was lifted, adjust the timer roller level as directed in Section 5.3.2.

5.129 Adjusting the Head Azimuth

The following illustration shows the locations of the head adjusting screws.



Note: Each head has five adjusting screws, the purposes of which are as follows:
① and ②: Head level adjusting screws
③: Azimuth adjusting screw
④: Securing screw
⑤: Head assembly installation screw

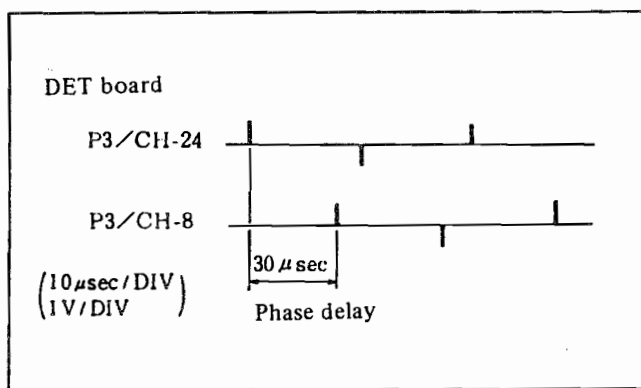
Table of cable-to-connector connections & check points for azimuth adjustments

Head	D/ADV REC	D/PB	D/SYNC REC	A/RP	A/E
Head connector	CN2	CN4	CN8	CN6	CN6
Cable No.	4			6	
Check points	CH-8 P3 and CH-24 P3 terminals on the DET board			ANALOG A1, A2 OUTPUT connectors	

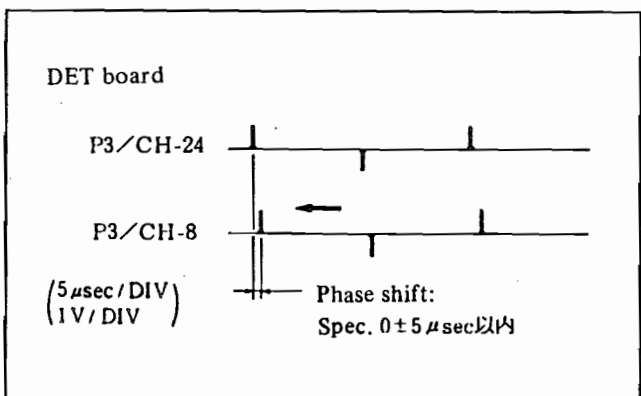
Adjusting D/ADV REC Head & D/SYNC REC Head Azimuth

Refer to the illustration shown on page 5-36 for the number marked with a circle in the following steps.

1. Connect an oscilloscope to the P3 terminals of CH-24 and CH-8 on the DET board.
2. Connect the connectors and cables as directed in the table shown on page 5-36, and play back the digital head azimuth adjustment tape.
3. Loosen screw ④ enough.
4. Rotate screw ③ and give CH-8 to the phase delay of 30 μsec .
(See diagram below.)



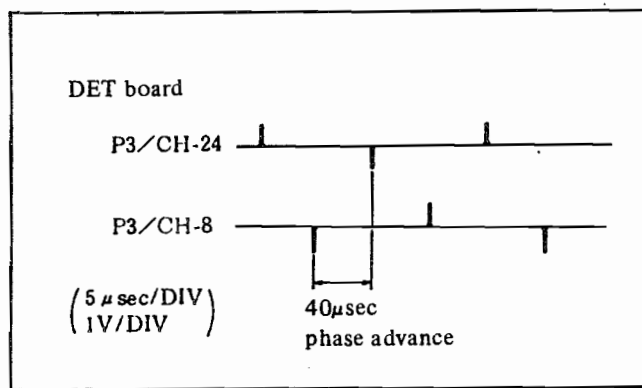
5. Tighten screw ④ to eliminate the phase difference between CH-24 and CH-8 (tolerance: within $0 \pm 5 \mu\text{sec}$; see diagram below).



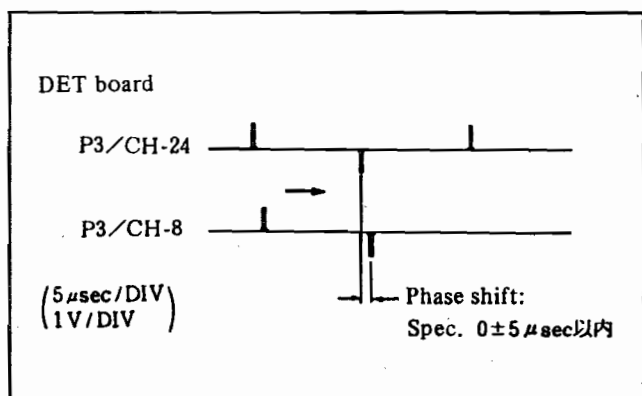
Adjusting D/PB Head Azimuth

Refer to the illustration shown on page 5-36 for the number marked with a circle in the following steps.

1. Connect an oscilloscope to the P3 terminals of CH-24 and CH-8 on the DET board.
2. Connect the connectors and cables as directed in the table shown on page 5-36, and play back the digital head azimuth adjustment tape.
3. Loosen screw ④ enough.
4. Rotate screw ③ and give CH-8 to the phase advance of 40 μsec .
(See diagram below.)

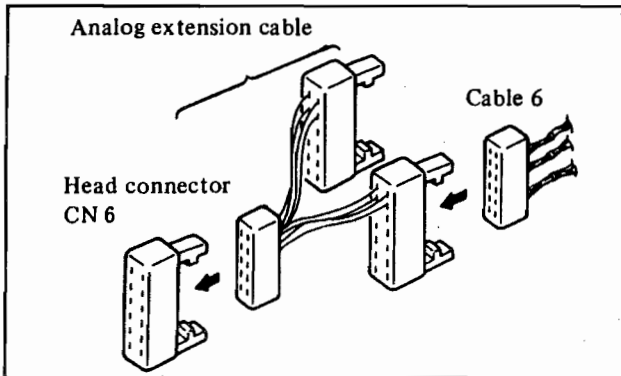


5. Tighten screw ④ to eliminate the phase difference between CH-24 and CH-8 (tolerance: within $0 \pm 5 \mu\text{sec}$; see diagram below).



Adjusting the A/E Head Azimuth

1. Connect analog CH1 and CH2 (A1 and A2, XLR connectors, on the rear panel) to an oscilloscope (the playback signal from the ARP board may also be used).



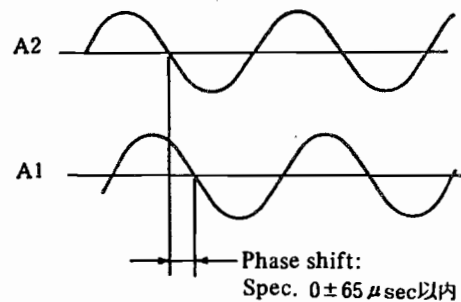
2. Unplug cable 6 from head connector CN6.
3. Insert the male connector of the analog extension jig into head connector CN6. Cable 6 is plugged into the left connector of the jig when the tape is played back with the left gap of the A/E head; it is plugged into the right jig connector when the tape is played back with the right gap. Since the right gap is used to determine the A/E head azimuth, plug cable 6 into the right jig connector to conduct the azimuth adjustment.
4. Play the analog head azimuth adjustment tape and rotate screw 3 to eliminate the phase difference between analog output A1 and A2 (tolerance: 20 sec; see diagram below).

Check to be sure the edges of the tape and the edges of the head core are absolutely parallel at this time. If they aren't, the output of A1 and A2 could deviate from one another by a full wavelength or more.

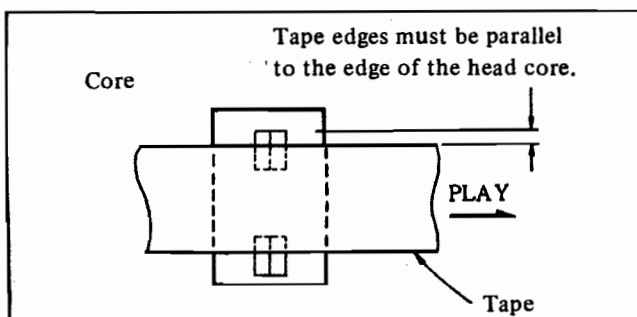
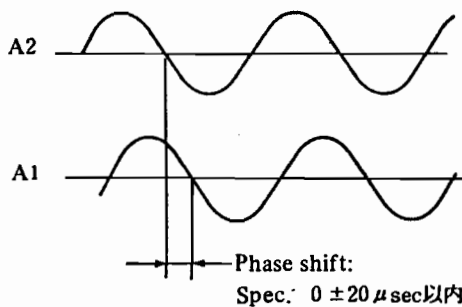
Adjusting the A/RP Head Azimuth

1. Connect analog CH1 and CH2 (A1 and A2, XLR connectors, on the rear panel) to an oscilloscope (the playback signal from the ARP board may also be used).
2. Connect the head connector and cable as directed in the table of cable-to-connector connections & check points for azimuth adjustments at the beginning of this section (the analog extension jig is not used), and play the analog head azimuth adjustment tape.
3. Rotate screw 3 to eliminate the phase difference between A1 and A2 (tolerance: 65 sec; see diagram below). Check to be sure the edges of the tape and the edges of the head core are absolutely parallel at this time.

ANALOG OUTPUT



ANALOG OUTPUT



5.12.10 Checking Head-to-Tape Contact

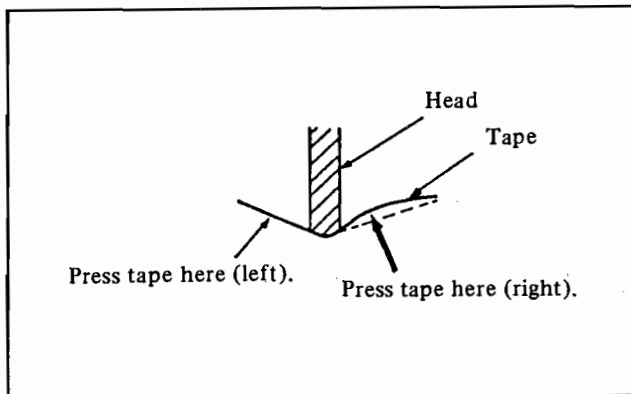
Table of cable-to-connector connections & check points for checking head-to-tape contact

Head	D/ADV REC	D/PB	D/SYNC REC	A/RP	A/E
Head connector	CN2	CN4	CN8	CN6	CN6
Cable No.	4			6	
Check points	P3 terminals of CH-1, 16 and 23 on the DET board			ANALOG A1 and A2 OUTPUT connectors on the rear panel	

Caution: A custom-made tape might have been used in the field, in addition to the tape path alignment tape (8-960-080-01). When performing the adjustment, check the specifications of the tape before using.

Checking the Head-to-Tape Contact of the D/ADV REC, D/SYNC REC, and D/PB Heads

1. Connect an oscilloscope to the P3 terminals of CH-1, 16 and 23 on the DET board.
2. Connect the connectors and cables as directed in the table above, and play the digital-head-to-tape contact adjustment tape.
3. Check that the amplitude of the waveform does not increase when the tape on either side of the D/ADV REC, D/SYNC REC, and D/PB heads is alternately lightly pressed with the fingers (see diagram, below).

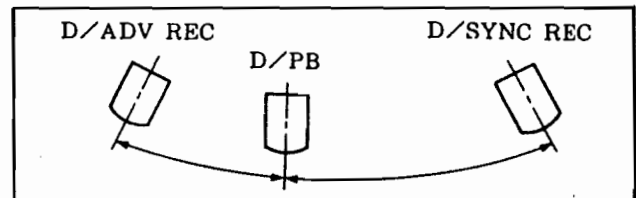


Checking the Head-to-Tape Contact of the A/RP and A/E Heads

1. Connect the analog CH1 and CH2 (A1 and A2, XLR connectors, on the rear panel) to an oscilloscope (the playback signal from the ARP board may also be used).
2. Connect the head connectors and cables as directed in the table of cable-to-connector connections & check points checking head-to-tape contact at the beginning of this section (use the analog extension jig for checking the A/E head contact only; refer to the illustration in the section on adjusting the A/E head azimuth for details on connecting the extension jig). Play the contact adjustment tape.
3. Check that the amplitude of the waveform does not increase when the tape on either side of the A/RP and A/E heads is alternately lightly pressed with the fingers.

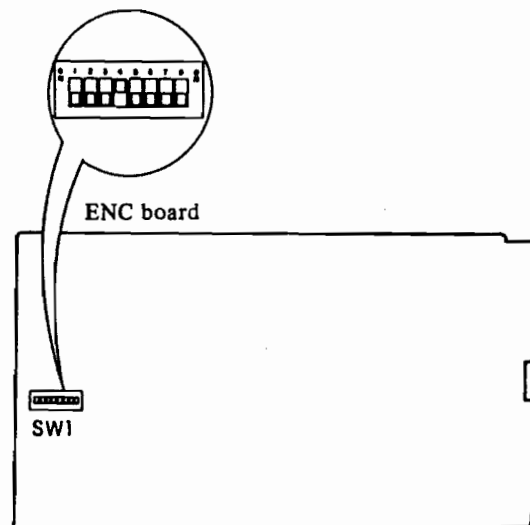
5.12.11 Adjusting the Head Spacing

Only the head spacing of the digital heads needs to be adjusted. Adjustment of the analog head spacing is not necessary because their spacing is determined by mechanical precision.

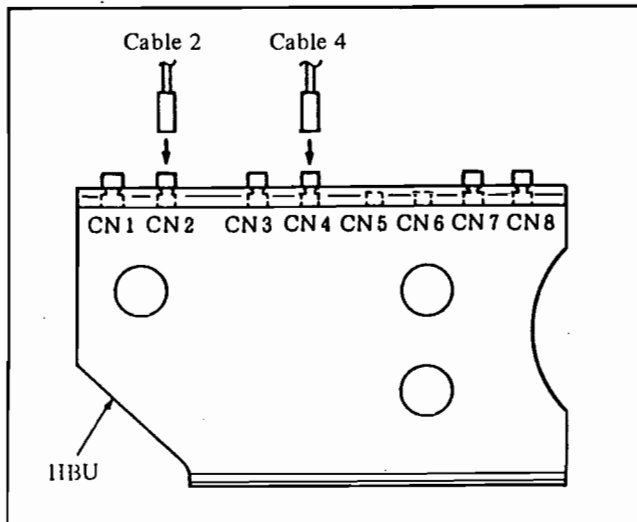


Adjusting the Head Spacing of the D/ADV REC and D/PB Heads

1. Turn ON switch No. 4 of DIP SW 1 (see diagram, below) on the ENC board (the left-most of the three boards). The TEST-2 LED should illuminate to show that the 4-block wavelength test signal is being generated.



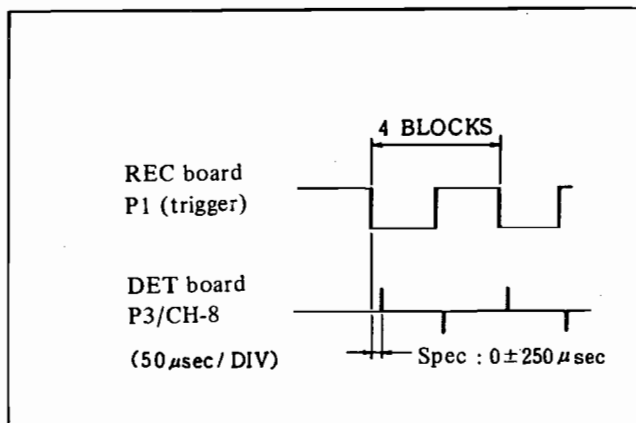
2. Connect the connectors and cables as shown below, load a blank tape, and put the machine in the ADVANCE REC mode.



3. Loosen the two M2.6 X 10 hexagonal socket-head screws (5) securing the head assemblies (screw locations are shown in the illustration at the beginning of Section 5.12.9).
4. Connect an oscilloscope to the CH8 P1 terminal on the REC board and to the CH8 P3 terminal on the DET board and observe their waveforms while swinging the D/ADV REC head assembly to the left or right with the eccentric screwdriver. Move the head assembly until the rise of REC board P1 coincides as closely as possible with the pulse output by P3 of the DET board (see diagram, below).

Check, with the phase meter of the CTL board, to be sure that the servo is locked at this time.

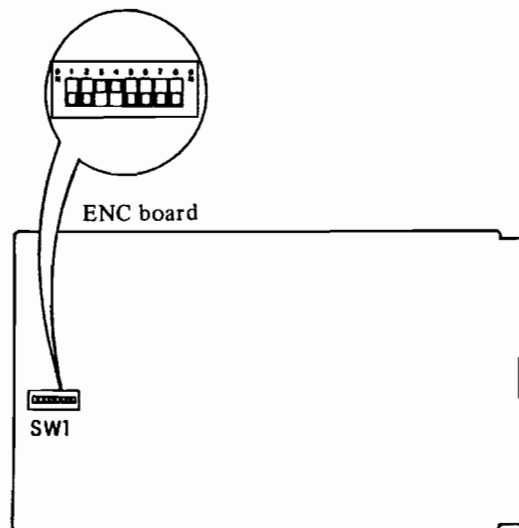
Note: If, after swinging the head, you lose track of its original position, position it so output at P3/CH8 on the DET board becomes maximum, then repeat step 4 to adjust the head spacing.



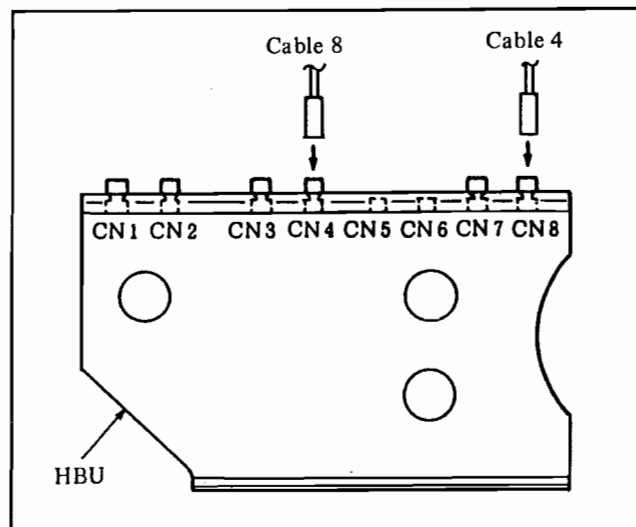
5. Secure the two M2.6 X 10 hexagonal socket-head screws loosened at step 3, with 8kg/cm torque. Make sure the head assembly does not shift while the screw is being tightened!

Adjusting the Head Spacing of the D/PB and D/SYNC REC Heads

1. Turn ON switches No. 3 and No. 4 of DIP SW 1 (see the following diagram) on the ENC board (the left-most of the three boards). The TEST-2 LED should illuminate to show that the 28-block wavelength test signal is being generated.



2. Connect the connectors and cables as shown below, load a blank tape, and put the machine in the ADVANCE REC mode.

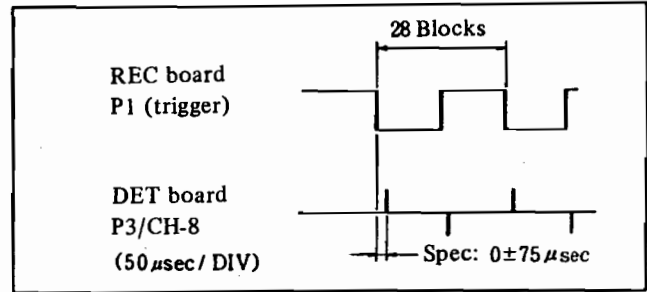


3. Loosen the two M2.6 X 10 hexagonal socket-head screws (5) securing the head assemblies.

4. Connect an oscilloscope to the CH8 P1 terminal on the REC board and to the CH8 P3 terminal on the DET board and observe their waveforms while swinging the D/SYNC REC head assembly to the left or right with the eccentric screwdriver. Move the head assembly until the rise of REC board P1 coincides as closely as possible with the pulse output by P3 of the DET board (see the following diagram).

Check, with the phase meter of the CTL board, to be sure that the servo is locked at this time.

Note: If, after swinging the head, you loose track of its original position, position it so output at P3/CH8 on the DET board becomes maximum, then repeat step 4 to adjust the head spacing.



5. Secure the two M2.6 X 10 hexagonal socket-head screws loosened at step 3, with 8kg/cm torque. Make sure the head assembly does not shift while the screw is being tightened!

5.12.12 Checking and Adjusting the Head Levels

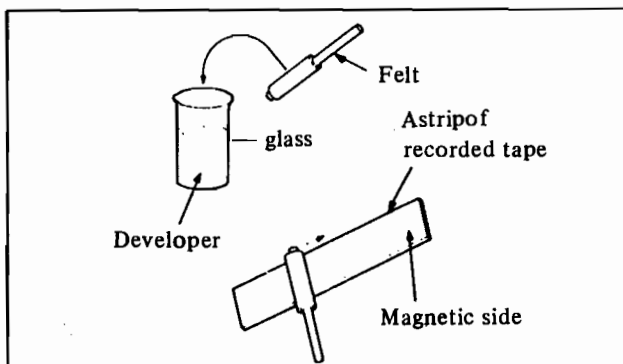
Check that head levels conform to the standards given in the following table. Head levels are check by recording on a section of tape and developing the tape; the method for accomplishing this is described below.

Head	D/ADV REC	D/PB	A/E		A/RP		D/SYNC REC
Distance from bottom edge of tape	First track, lower edge (A) MIN* ~ MAX* mm	First track, lower edge (A) MIN* ~ MAX* mm	A2 track, lower edge (B)	$0.37 \pm 0.045\text{mm}$	A2 track, lower edge (B)	$0.31 \pm 0.035\text{mm}$	First track, lower edge (A) MIN* ~ MAX* mm
			TC track, lower edge (C)	$5.9 \pm 0.045\text{mm}$	TC track, lower edge (C)	$5.965 \pm 0.035\text{mm}$	
			TC track, upper edge (D)	$6.3 \pm 0.045\text{mm}$	TC track, upper edge (D)	$6.235 \pm 0.035\text{mm}$	
			A2 track, lower edge (E)	$12.27 \pm 0.045\text{mm}$	A2 track, lower edge (E)	$12.33 \pm 0.035\text{mm}$	

*Refer to the Head Inspection Standards furnished with the PCM-3324, or with the Replacement Head Block Unit RKA-3324E, for the minimum and maximum values for these heads.

Developing technique

Put the developer into a tall glass beaker or similar container. Attach a strip of felt around a dowel, saturate the felt with developer, and apply the developer uniformly to the magnetic side of a strip of recorded tape.

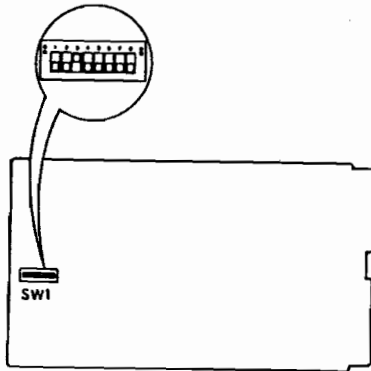


We suggest using a developer which has proven its effectiveness on video tapes; a reliable developer may be obtained from the following sources:

- Ferikoido HC-60
Taih Kgy, Ltd.
44-21-2 Takanawa, Minato-ku, Tokyo, Japan
- Ferrofluidics EMG508
Ferrofluidics Corporation
40 Simon Street
Nashua, NH 0306_ U.S.A.

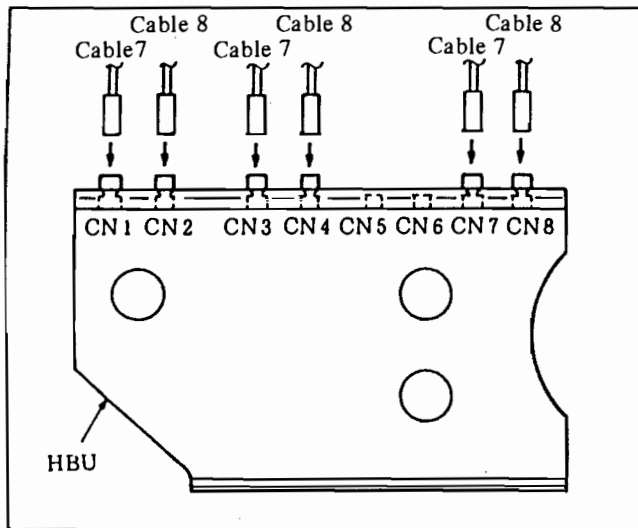
Checking the Level of the D/ADV REC, D/PB, and D/SYNC Heads

1. Turn switch No. 3 of DIP SW1 (see diagram, below) on the ENC board, the left-most of the three boards. The TEST-2 LED should illuminate to show that the 2fs test signal is being generated.

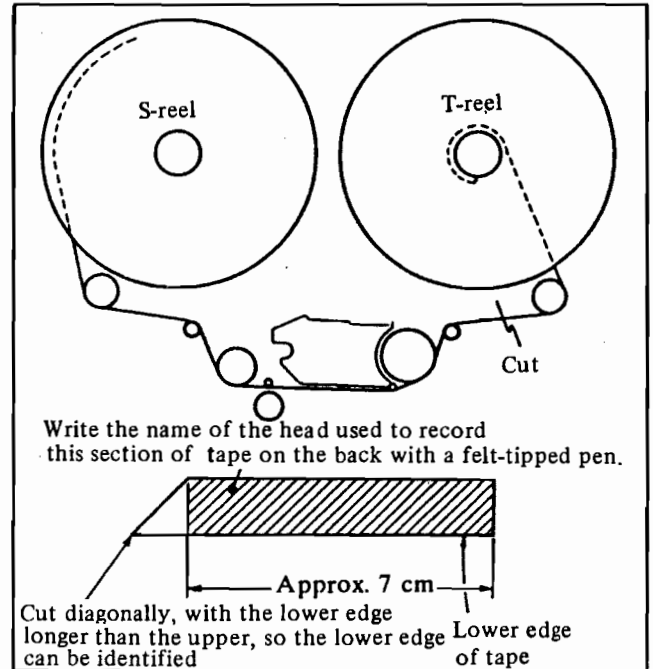


2. Connect the cables and connectors as directed in the following table (and illustrated below), and record the test signal on a blank tape for about 10 seconds for each head, in the ASSEMBLE mode.

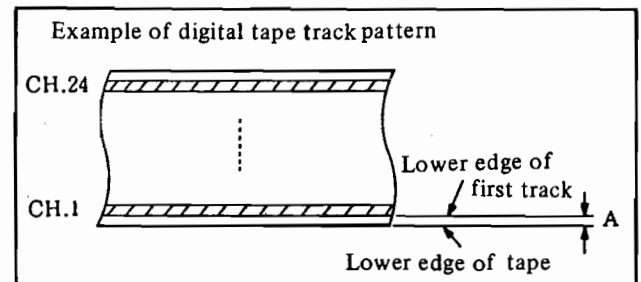
Head		D/ADV REC		D/PB		D/SYNC REC	
Connections	Connector	CN-1	CN-2	CN-3	CN-4	CN-7	CN-8
	Cable	7	8	7	8	7	8



3. From the recorded tape, splice out to samples such as the one illustrated below for taking measurements, and apply the developer uniformly to the samples.



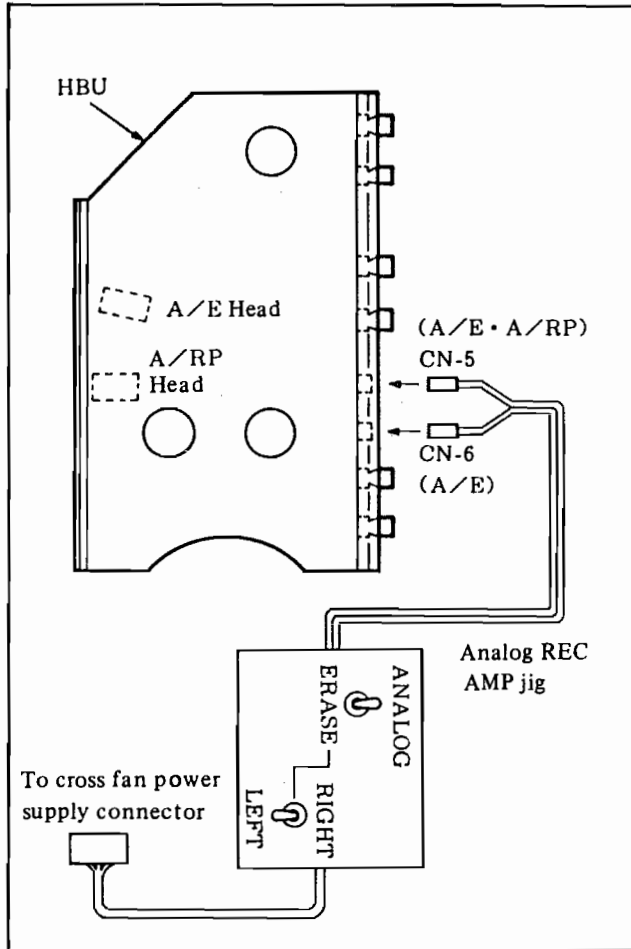
4. Study one of the samples under a microscope and measure the distance from the lower edge of the tape to the lower edge of the first track (distance "A"); keep the other sample as a spare.



5. Compare the measurements with the standards given in the table at the beginning of this section to make sure they comply with the tolerances. If the measured distance exceeds the tolerances for the head with which the tracks were recorded (conduct this test separately for each head), adjust the head level as directed later on in this section.

Checking the Level of the A/E and A/RP Heads

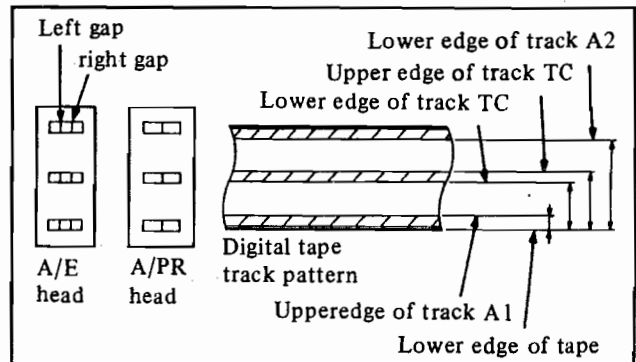
1. Connect the analog recording amp jig to the HBU connectors as shown below. Take the 15V power supply for the jig from the cross fan power supply connector.



2. Set the jig switches according the table below, load a blank tape, and run the tape in the PLAY mode for about ten seconds; signals from the jig will be recorded on the tape.

ANALOG/ERASE switch	LEFT/RIGHT switch	Corresponding head
ANALOG	—	A/RP
ERASE	LEFT	A/E (left gap)
	RIGHT	A/E (right gap)

3. Splice out and develop two samples of recorded tape as described in step 3 of the previous section, "Checking the Level of the D/ADV REC, D/PB, and D/SYNC Heads."
4. Study one of the samples under a microscope and measure the distances from the lower edge of the tape to the upper edge of track A1 (B), the upper (C) and lower (D) edges of track TC, and the lower edge of track A2 (E); keep the other sample as a spare.

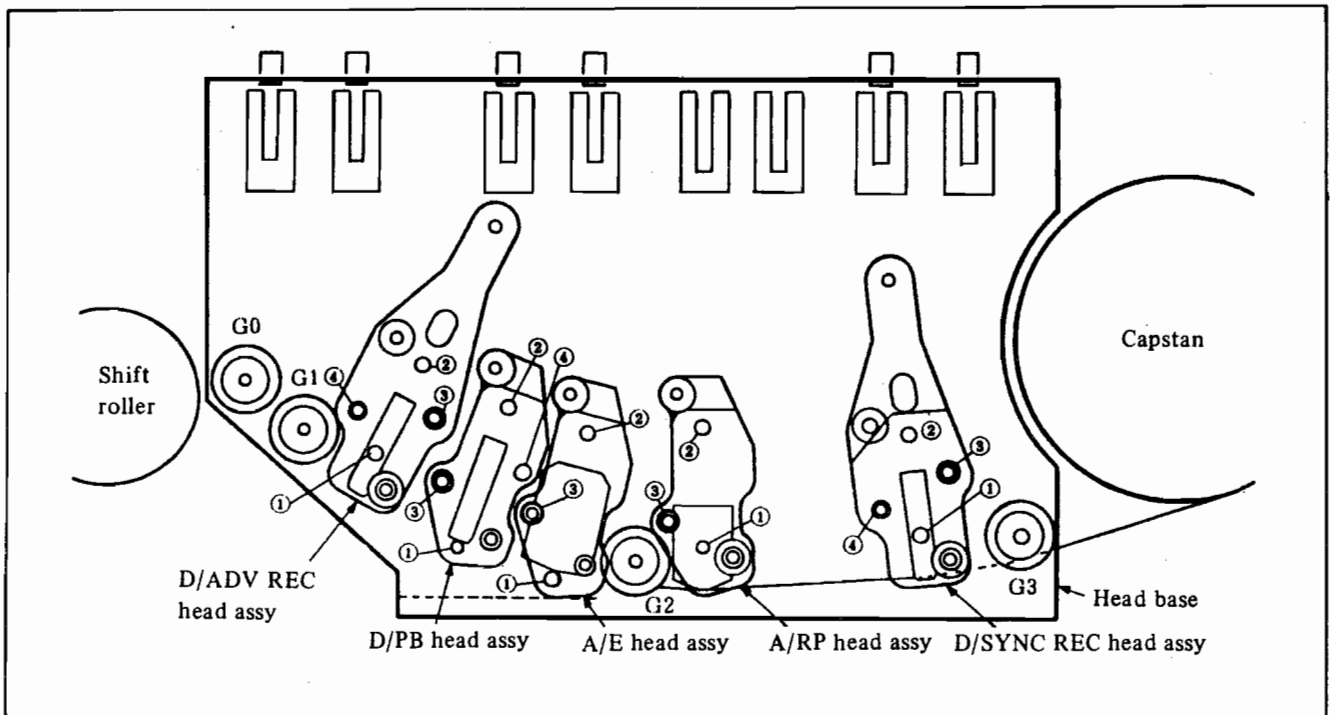


5. Compare the measurements with the standards given in the table at the beginning of this section to make sure they comply with the tolerances. If the measured distances exceed the tolerances for the head with which a track was recorded, adjust the head level as directed later on in this section.

Adjusting the Head Levels

The locations of the screws for adjusting the head levels are shown in the diagram below.

Locations of Head Adjusting Screws



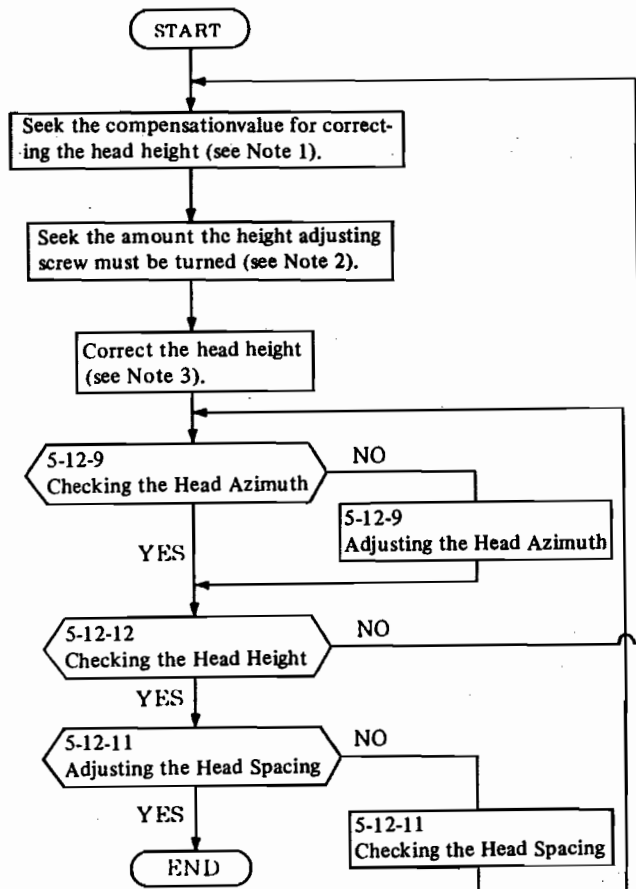
Each head has four screws for adjusting the head level, the purposes of which are as follows:

(1) and (2): Head level adjusting screws

(3): Azimuth adjusting screw

(4): Securing screw

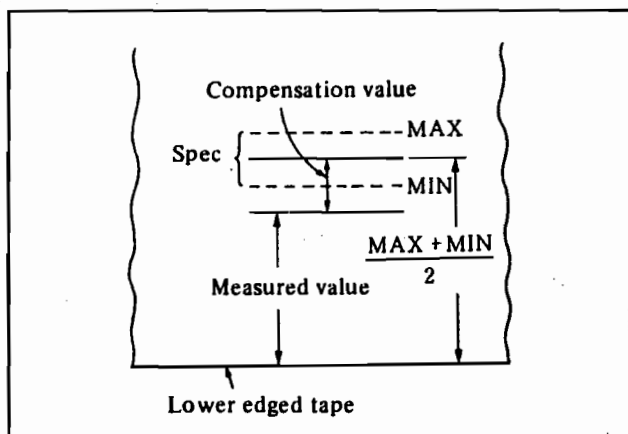
Check the level of each head. If measurements do not conform to the standards given in the table at the beginning of this section, 5.12.12 Checking and Adjusting the Head Levels, adjust their levels according to the following flowchart.



Note 1: The formula for seeking the head level compensation value is as follows:

$$\text{Comp. value} = (\text{measured value}) - \frac{(\text{MAX} + \text{MIN})}{2}$$

Compensation value Target (standard) Measured value
Lower edge of tape



Note 2: The formula for seeking the amount the head level adjusting screw must be rotated is as follows:

$$\text{Amount of rotation} = 360 \times \frac{(\text{compensation value (m)})}{500}$$

(500 represents the pitch (m) of the level adjusting screw)

Note 3: How to correct the head level

To adjust the D/ADV REC, D/PB, and D/SYNC REC heads, first loosen the securing screw (4) (do not loosen the securing screw of the other heads when adjusting them).

Using the precision screwdriver with the protractor (jig #16), turn the level adjusting screws (1) and (2) the amount sought with the formula given at Note 2 to adjust the head level. Turn both screws in the same direction.

When the compensation value is positive, turn the screws clockwise; when it is negative, turn the screws counterclockwise.

5.13 Replacing the Fans

Replace the fans under the following conditions:

- When fan replacement is required by the periodic inspection schedule in Section 4;
- When one of the fan alarm lamps illuminates;
- When a fan generates abnormal noises.

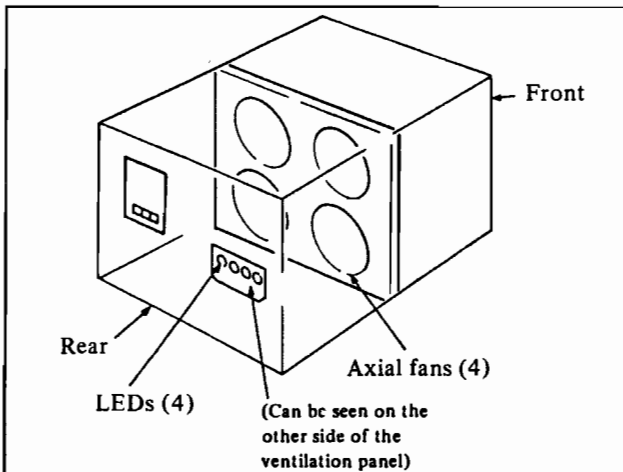
5.13.1 Pinpointing Defective Fans

There are two occasions when a defective fan must be located: when a fan begins generating abnormal noises, and when a fan alarm occurs. To pinpoint the defective fan in the latter case, proceed as follows:

The procedures given subsequently describe how to find the defective fan when one of the fan LEDs among the system alarm indicators at the right of the front level meters, illuminates.

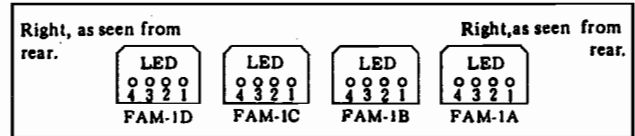
How to find a defective fan in the power unit

1. Look through the slit in the rear panel of the power unit to see whether the four LED lamps on the FAN-3 (fan alarm) board are illuminated or not.
2. If the an LED is illuminated, one of the power unit's fans is malfunctioning. Follow the instructions in 5.13.2, "Replacing Fans" to replace the defective fan.



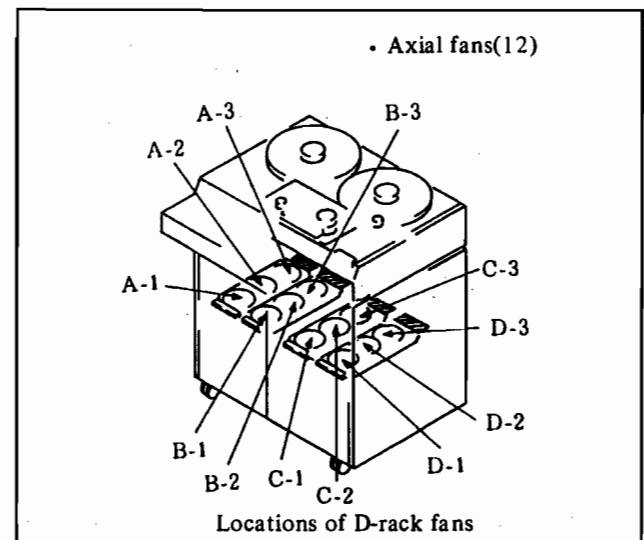
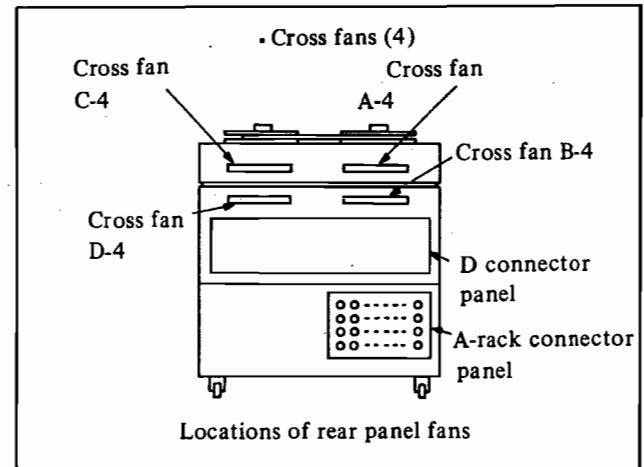
How to find defective D-rack or rear-panel fans

1. Open the D-rack connector panel. There are four FAN-1 boards at the lower front of rack D with four LEDs on each rack. Check whether any of the LEDs is illuminated.



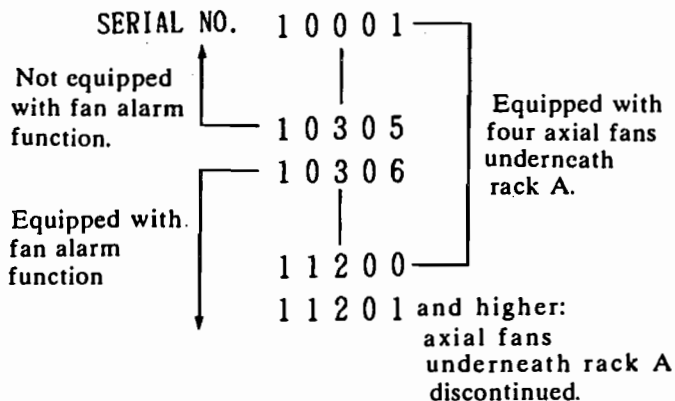
Note: Each No. 1, 2, and 3 LED indicates a D-rack (axial) fans; No. 4 LEDs indicate rear panel (cross flow) fans.

2. If any of the LEDs is illuminated, the corresponding D-rack fan or rear-panel fan is malfunctioning. Follow the instructions in 5.13.2, "Replacing Fans" to replace the defective fan.



How to find defective A-panel fans

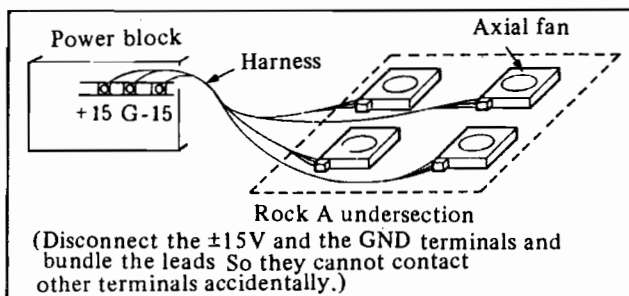
The method for discover defective A-panel fans, and furthermore whether a PCM-3324 is equipped with A-panel fans, depends on the serial number of the unit, as shown below.



Early PCM-3324s were equipped with four axial fans underneath rack A, which could be accessed by opening the rack A connector panel. However, the PCM-3324 is sufficiently cooled even without these fans, making the fans superfluous. Their replacement is therefore unnecessary, and they should be disconnected as directed below, rather than replaced.

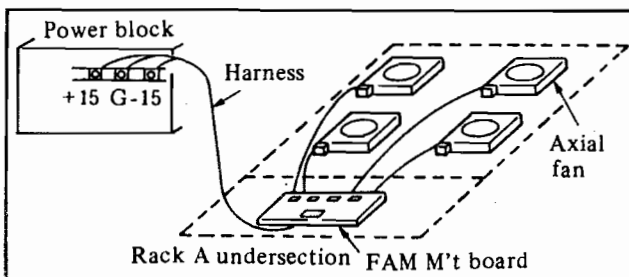
Serial nos. 10001 – 10305

On serial nos. 10001 to 10305, disconnect the rack A axial fans by disconnecting their power supply from the supply terminals on the power block.



Serial nos. 10306 – 11200

On serial nos. 10001 to 10305, disconnect the rack A axial fans by disconnecting the power supply harness to the FAN-2 board on rack A. The fans need not be replaced.



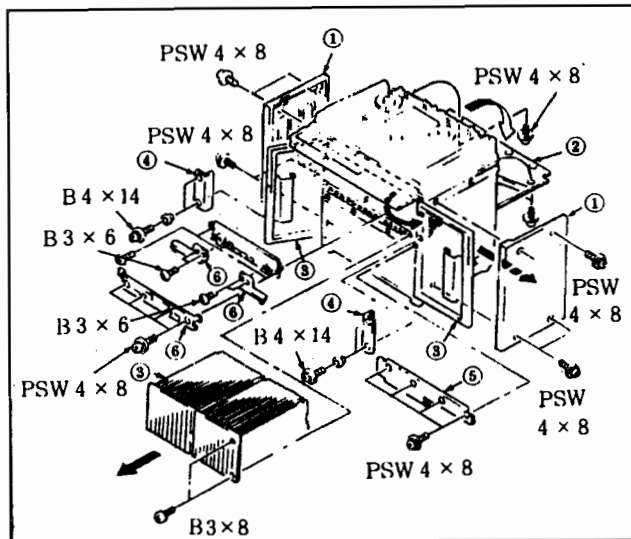
5.132 Replacing Fans

The encircled numbers ([N]) in the subsequent instructions correspond to the encircled numbers in the accompanying illustrations.

Replacing D-rack fans (12 units)

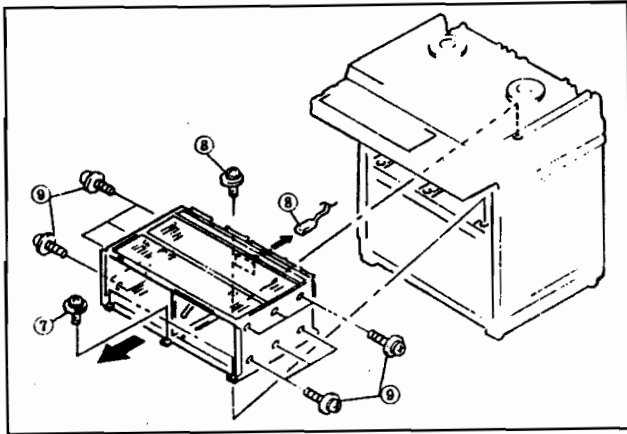
1. Remove the exterior panels and mountings:

- (1) Unfasten the eight PSW4 X 8 screws (four per side) and remove the left and right side panels.
- (2) Unfasten the six PSW4 X 8 screws securing the D-rack connector panel on the rear of the machine, and remove the connector panel.
- (3) Open the front doors and remove all of the circuit boards from rack D.
- (4) Unfasten the two B4 X 14 cross recessed head screws securing the face plates at the left and right of rack D, and remove the face plates.
- (5) Unfasten the four PSW4 X 8 screws securing the circuit board indicator panel at the bottom of rack D, and remove the panel.
- (6) Unfasten the four PSW4 X 8 and four PSW3 X 8 screws securing the panel and door stoppers at the top of rack D, and remove the dress plate and stoppers.



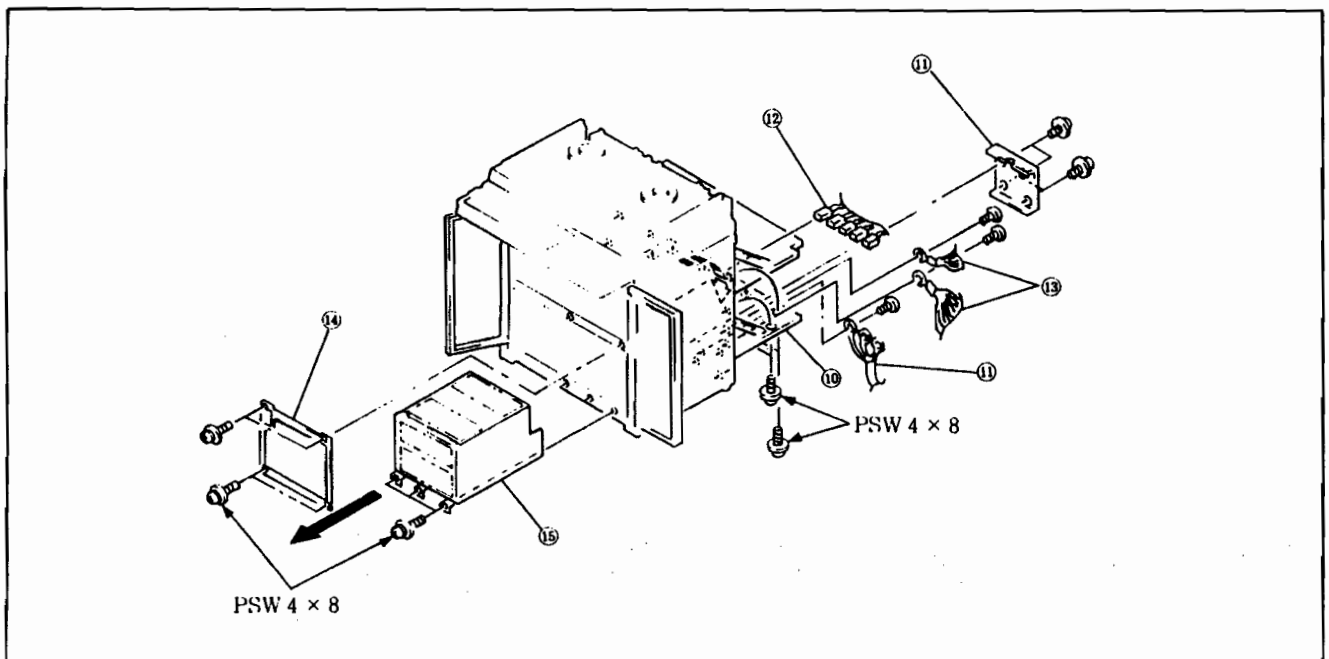
2. Remove the rack:

- (7) Remove the three PSW4 X 8 retaining screws at the front of rack D. (7)
 - (8) Remove the PSW4 X 8 retaining screw in the center at the rear of rack D. Disconnect the D-rack ground lead from the VT-1 board. (8)
 - (9) Unfasten the twelve (six on each side) PSW4 X 10 rack setscrews on the sides of rack D. (9)
- The upper and lower rack panels and the central divider of rack D can now be removed as a unit by pulling them forward, out of the main unit.



3. Replace the axial fans:

- (10) Loosen the four setscrews and disconnect the connect of each fan to be replaced, remove the old fan, and install the new one.



Replacing power unit fans (four units)

1. Remove the power unit:

- (11) Before removing the power unit, temporarily secure the D-rack connector panel with a screw.
- (12) Unfasten the seven PSW4 X 8 screws securing the A-rack connector panel at the rear of the machine, and remove the panel. (12)
- (13) Unfasten the four screws securing the power cord terminal connector cover and remove the panel, then remove the power cord wires (three) from their terminals. (13)
- (14) Disconnect the five IL connectors from the secondary power supply terminals. (14)
- (15) Unfasten the screw and open the D-rack connector panel, then remove the D-rack 5V power supply lines (bundle of ten leads) and ground lines (bundle of six). Also remove the 5V and ground lines to the sensor at the center of rack D.

Pull these four wires down to the power unit.

Note: Cut the bands on the wires that secure them here and there to the unit.

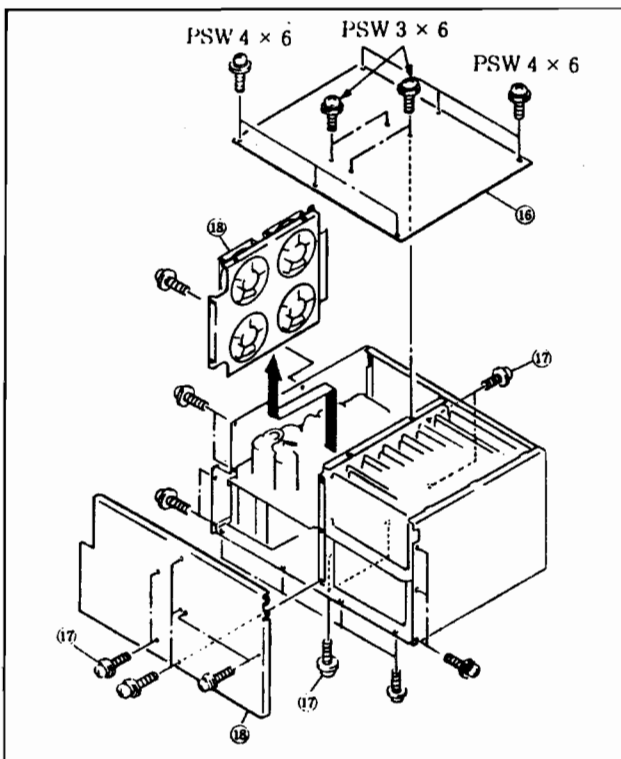
- (16) The power unit is now completely disconnected from the PCM-3324. Unfasten the four PSW4 X 8 screws and remove the power unit dress plate. (16)
- (17) Unfasten the three PSW4 X 8 screws and pull the power unit out of the frame. (17)

Note: There are rails on the bottom of the power unit; do not allow the unit to hit the ground so as to avoid damaging them.

2. Remove the fan mount from the power unit:

- (18) Unfasten the six PSW4 X 6 and five PSW3 X 6 screws and remove the upper panel. ⑩
- (19) Remove the six (two each from the right, left, and bottom panels of the power unit) PSW3 X 6 screws securing the fan mount. ⑪
- (20) Unfasten the nine PSW3 X 6 and four PSW4 X 6 screws of the right side panel and remove the panel (the left side panel need not be removed). Slide the fan mount a little to the right and remove it by lifting it out of the power unit. ⑫

Note: Be careful not to damage the harness (leads to the axial fans) when lifting the fan mount out of the power unit.

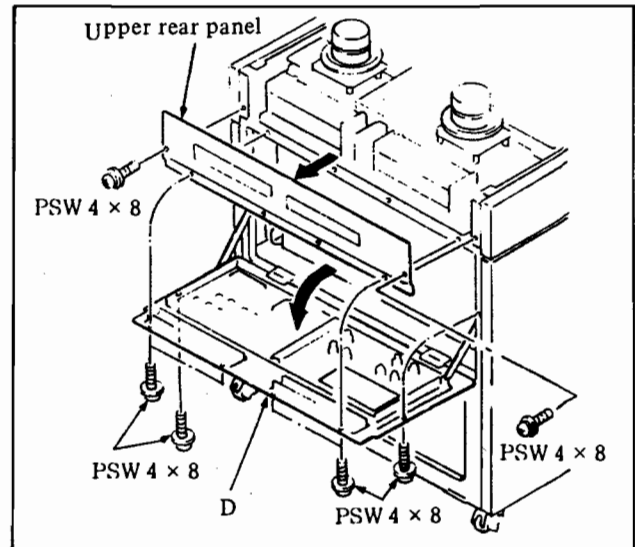


3. Replace defective fans:

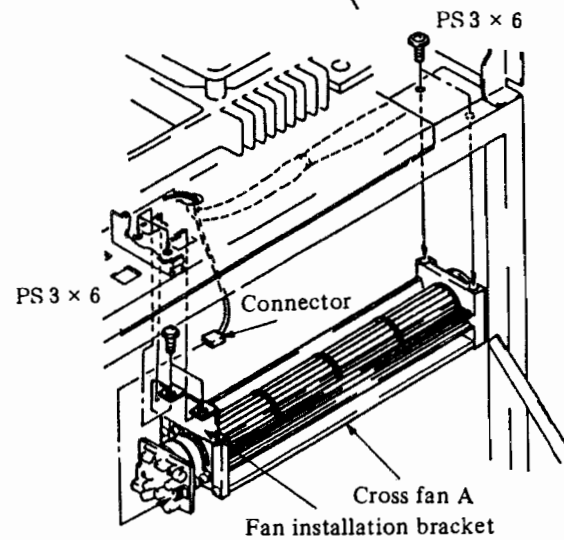
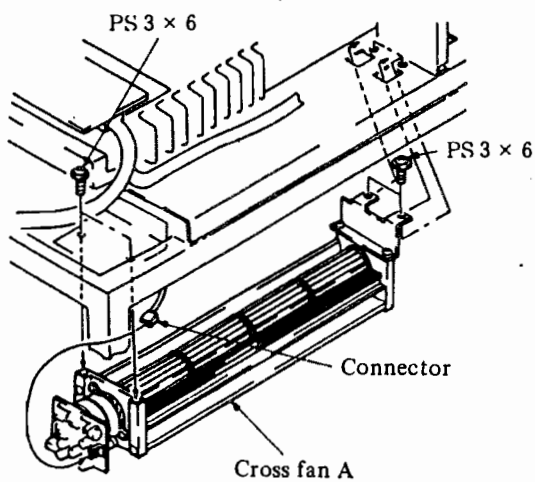
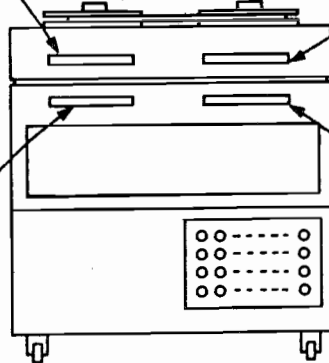
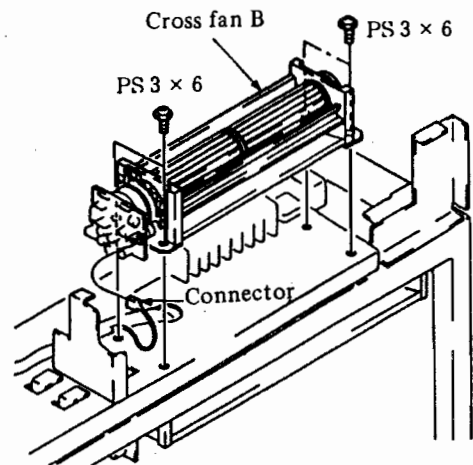
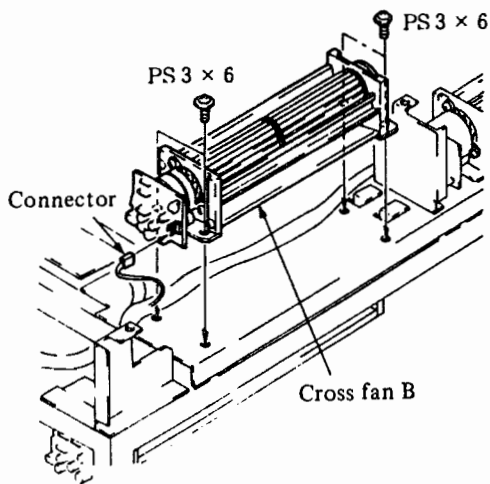
Unfasten the four screws and disconnect the connector of each axial fan to be replaced, remove the old fan, and install the new one with the connector facing the same direction as that of the old fan.

Replacing rear panel fans

1. Remove the upper panel of the machine and open the D-rack connector panel (refer to Section 3 for instructions).
2. Unfasten the four PSW4 X 8 screws and remove the upper rear panel.



3. Disconnect the connector from the circuit board of the cross fan to be removed.
4. Unfasten the four PS3 X 6 screws and replace the cross fan (see illustration, below).
When installing a new cross fan A, separate the installation fixture from the old fan and attach it to the new one before installing.



SECTION 6 ELECTRICAL ADJUSTMENTS

This section describes the electrical adjustments necessary when conducting repairs and maintenance. The instructions in this section have been written on the assumption that all adjustment items preceding and subsequent to the adjustment to be conducted, are in proper adjustment. In cases where more than one adjustment may be necessary to correct a malfunction or misadjustment, we recommend conducting all related adjustments in correlation to one another.

This section concerns itself mainly with adjustments of switches and controls located within the PCM-3324; these adjustments are necessary to maintain performance characteristics that conform with standard specifications.

Important Note

Some of the adjustments described in this section require, in addition to switch and control settings, that the tape end slow function (tape end sensor)* be released before adjustments are begun. All of the adjustments in this section may be carried out with the tape end slow function released, thus it is not necessary to restore the function until all adjustments have been completed. Note that the tape end slow function must be released for those adjustment items for which its release is specifically prescribed (see list, below).

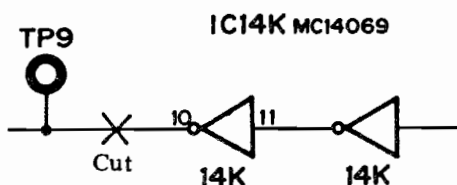
*: Releasing the tape end slow function (tape end sensor) makes it possible to operate the capstan motor independently of the reel motors.

Release of the tape end slow function

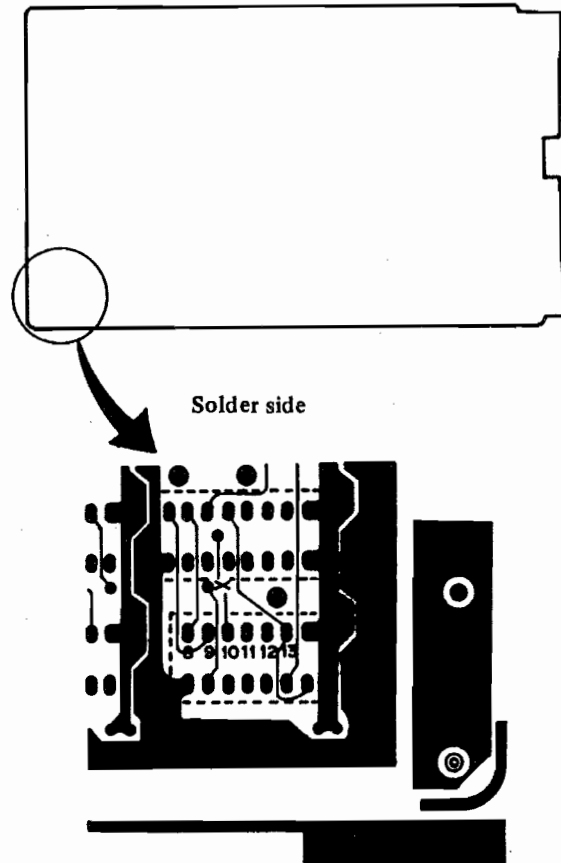
Applicable machines: serial number 11401 and higher
Applicable circuit board number: SYS board 1-607-395-15

Procedure

Cut the conductor pattern leading from pin 10 of IC14K (MC14069) on the SYS board.



SYS board (1-607-395-15)
Component side

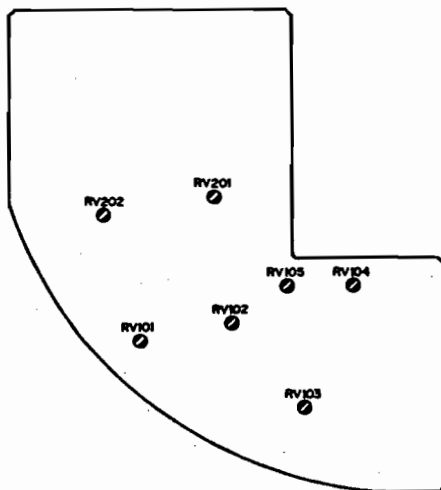


After completing adjustments, restore to normal by connecting a jumper line between the through hole at the bottom of IC13K and pin 10 of IC14.

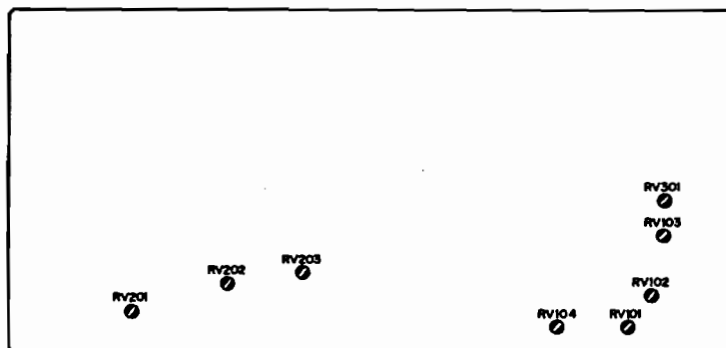
Release of the tape and slow function applicable adjustments for adjusting tape and slow

- 6.1.1 2. Capstan drive voltage balance adjustment (DRV-1 board)
- 6.1.1 3. Capstan motor power supply adjustment (DRV-1 board)
- 6.1.2 1. HEA output adjustment (HEA board)
- 6.2.1 3. Tension regulating potentiometer tentative adjustment (SRVO block 1)
- 6.2.3 2. FF speed adjustment (SRVO block 3)
- 6.2.4 2. FF/REW acceleration time adjustment (SRVO block 5)
- 6.2.4 3. FF/REW deceleration time adjustment (SRVO block 5)

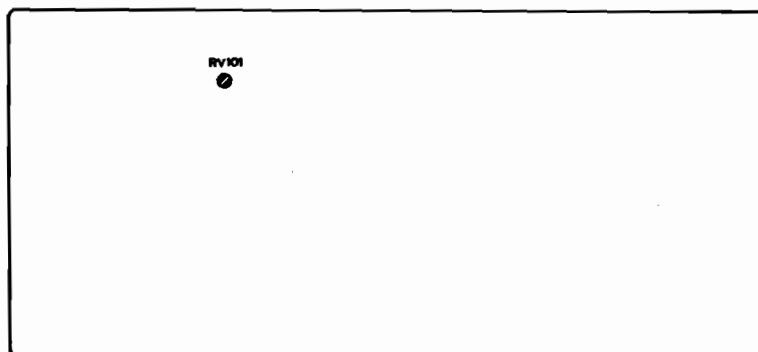
Points of adjustment



HEA Board — Component Side —
(No. 1-607-405-11)



DRV-1 Board —Component Side—
(No. 1-607-397-12)



DRV-2 Board —Component Side—
(No. 1-607-398-02)

6.1 Adjusting the Motor Drive Systems

This section describes adjustments of the capstan motor and reel motor drive systems. The adjustments should be carried out after replacing the HEA board, DRV-1 board, or the DRV-2 board, or any of their components, and after replacing the capstan motor.

6.1.1 DRV-1 Board Adjustments

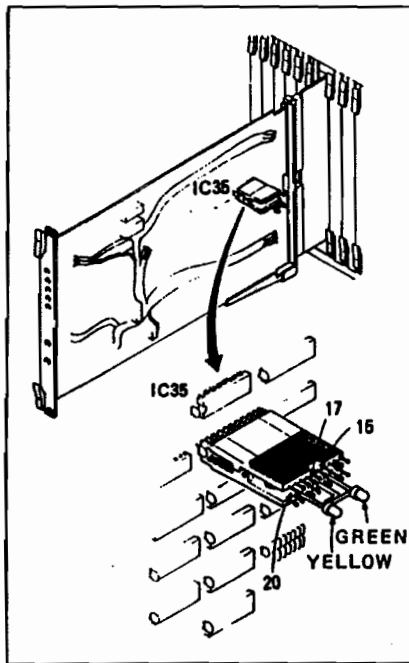
Required equipment: Oscilloscope
Wow-and-flutter meter
(MK-615 or equivalent)
DC voltmeter

Low tension jig (1) (jig #11)

Preliminary switch and control settings

Power switch: OFF

Use the extension board to access the SRVO board. Attach extension board to access the SRVO board. Attach the low tension jig (1) to SRVO board IC35 with the LED facing upward, and slip the jig flush against pin 20. SRVO board S2 (TEN SRV): OFF
Unplug CCB board CN104.



Points of adjustment

Points of adjustment:
DRV-1 board: ●RV101, 102, 103, 104, 201, 202, 203, 301
HEA board: ●RV105

Adjustment procedure

1. IC offset adjustment
Disconnect DRV-1 CN7.
Turn the power ON.
Press the tension disarm switch.

Rough adjustment

Disconnect DRV-1 CN3.

Specification: Voltage at CP102 and CP202= 0 ± 100 mVdc (Refer to the following note).

Adjustment: ●RV102 (CP102), RV202 (CP202)

Fine adjustment

Reconnect DRV-1 CN3.

Specification: Voltage at CP102 and CP202= 0 ± 20 mVdc.
(Refer to the following note).

Adjustment: ● RV102 (CP102), RV202 (CP202)

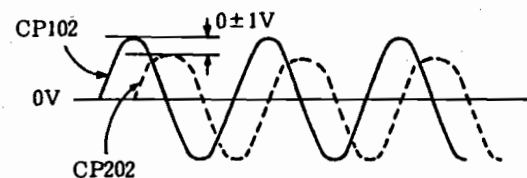
Turn the power OFF and reconnect DRV-1 CN7.
Note: When using an oscilloscope, align the center of the noise that has been overlapped with 0 ± 20 mVdc.

2. Capstan drive voltage balance adjustment
Set RV105 on the HEA board to its mechanical center.
Turn the power ON.
Press the tension disarm switch.

Press the FF and play keys (REW and play keys) simultaneously to activate the slow-forward (slow-reverse) mode. Activate the slow-forward and slow-reverse modes alternately while conducting the following adjustment.

Specification: Amplitude difference of CP102 and CP202 on the DRV-1 board= $0\pm 1V$

Adjustment: **RV104** on the DRV-1 board



If the above specification cannot be achieved, adjust as follows:

Specification: Amplitude difference of CP102 and CP202 on the DRV-1 board= $0\pm0.5V$

Adjustment: ☒RV105 on the HEA board

3. Capstan motor power supply adjustment
Turn the power ON.
Press the tension disarm switch.

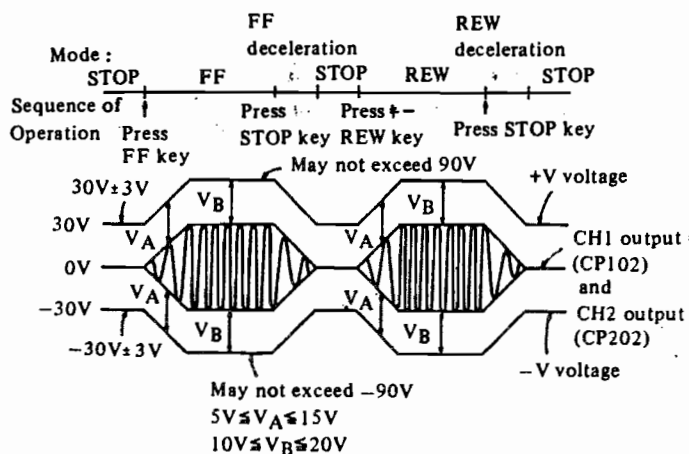
Specification:

Voltage of DRV-1 board +V test point: $5V \leq V_A \leq 15V$

Voltage of DRV-1 board -V test point: $10V \leq V_B \leq 20V$

Note: V_A refers to the power supply voltage, as the drive voltage, during acceleration in the FF and REW modes; V_B refers to the power supply voltage, as the drive voltage, at the normal FF/rew mode speed.

Adjustment: $\odot$ RV301 on the DRV-1 board

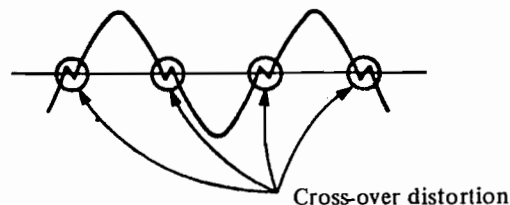


4. Final stage transistor idling current adjustment
Turn the power ON.
Disconnect CN1 on the DRV-1 board.
Specification: Terminal voltage at R123 and R223 = $5\text{ mV} \sim 10\text{ mVDC}$

Note: Take measurements while the temperature of the DRV-1 board heat sink is in the range of $30^\circ\text{C} \sim 40^\circ\text{C}$ (i.e., not hot to the touch). Let the machine rest [so the heat sink can cool] if it has been operated in the FF or REW modes before measuring these voltages.

Adjustment: $\odot$ RV103 (R123) and RV203 (R223) on the DRV-1 board
Reconnect DRV-1 CN1 and put the machine in the play mode.

Confirmation: Observe the waveforms of CP102 and CP202 on the oscilloscope to make sure there is not cross-over distortion.



When adjusting the HEA board after completing the above-described DRV-1 board adjustment, the following wow and flutter adjustment is conducted on the HEA board, and the wow-and-flutter adjustment [of the DRV-1 board] may be omitted here.

5. Capstan motor wow-and-flutter adjustment
Turn the power ON.
Press the tension disarm switch.
Put the machine in the play mode.

Specification: wow and flutter at SRVO board TP401: max. 0.015% (unweighted, RMS, $f_c 200\text{ Hz}$, fourth LRF).

Adjustment: adjust $\odot$ RV102 and $\odot$ RV202 alternately, alternately.

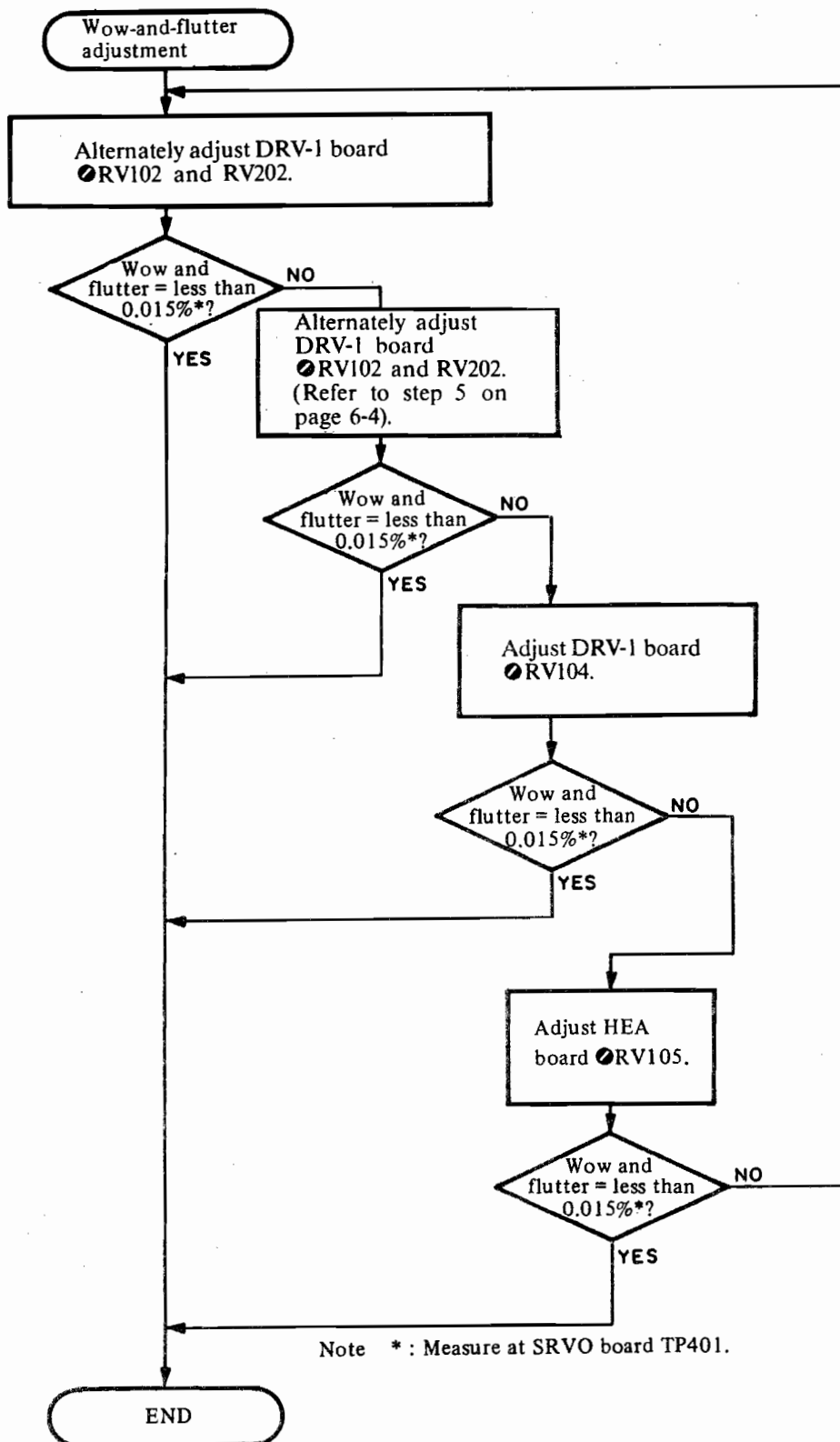
If the above specification cannot be obtained, adjust DRV-1 $\odot$ RV101 and $\odot$ RV201 alternately. (Refer to the following Note).

If the specification still cannot be obtained, adjust DRV-1 $\odot$ RV104.

If the specification cannot be achieved even by adjusting $\odot$ RV104, adjust HEA board $\odot$ RV105.

If, after attempting all of the above adjustments, the specification remains unobtainable, return to step 1 and begin the adjustments anew. If wow and flutter still cannot be reduced to 0.015% or below after attempting to adjust it a few times, the capstan motor must be replaced.

Note: When turning $\odot$ RV101 and $\odot$ RV201 ccw, several kHz of oscillation may occur. Therefore, complete the adjustment just before the oscillation starts. (approx. 5°).

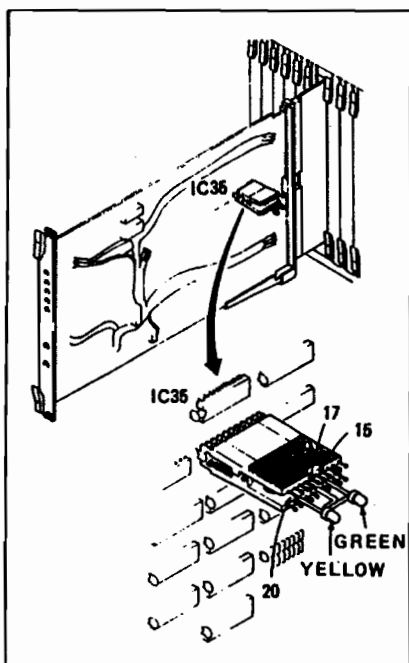


6.1.2 HEA Board Adjustment

Required equipment: Oscilloscope
Wow-and-flutter meter
Low tension jig (1) (jig #11)

Preliminary switch and control settings
Power switch: OFF

Use the extension board to access the SRVO board.
Attach the low tension jig (1) to SRVO board IC35 with the LED facing upward, and slip the jig flush against pin 20.



SRVO board S2 (TEN SRV): OFF
Unplug CCB board CN104.

Points of adjustment

HEA board: RV101, 102, 103, 104, 105, 201, 202
DRV-1 board: RV101, 102, 104, 201, 202

Adjustment procedure

1. HEA output adjustment

Turn the power ON.
Press the tension disarm switch.
Check to be sure the capstan motor is completely still.

Specification: 0 ± 5 mV DC at I/O terminal 1

Adjustment: RV101

Specification: 0 ± 5 mV DC at I/O terminal 2

Adjustment: RV103

Conduct the following adjustment while alternately putting the machine in the FF and REW modes:

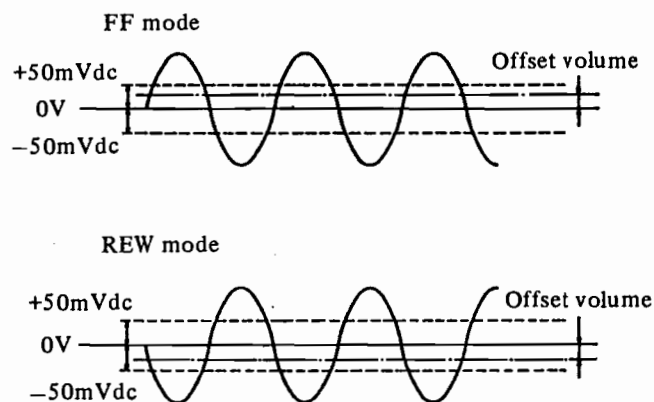
Specifications: Offset of terminal 1 in the FF/REW mode: 0 ± 50 mV DC

Adjustment: HEA board RV102

Conduct the following adjustment while alternately putting the machine in the FF and REW modes:

Specification: Offset of terminal 2 in the FF/REW mode: 0 ± 50 mV DC

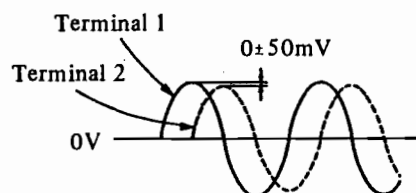
Adjustment: HEA board RV104



Put the machine in the play mode.

Specification: amplitude difference of terminals 1 and 2 in the play mode: 0 ± 50 mV

Adjustment: HEA board RV105



2. Capstan motor wow-and-flutter adjustment
Conduct the capstan wow-and-flutter adjustment as directed in step 5 of "6-1-1. DRV-1 board adjustments".

3. Capstan motor FG output adjustment
Turn the power ON.
Press the tension disarm switch.
Put the machine in the play mode.

Specification: 8 Vp-p at I/O terminal 9, with wow and flutter at SRVO board TP401 0.015% or less (unweighted, rms, fc200 Hz, fourth LPF)

Adjustment: Adjust HEA board ●RV201 and ●RV202 alternately.

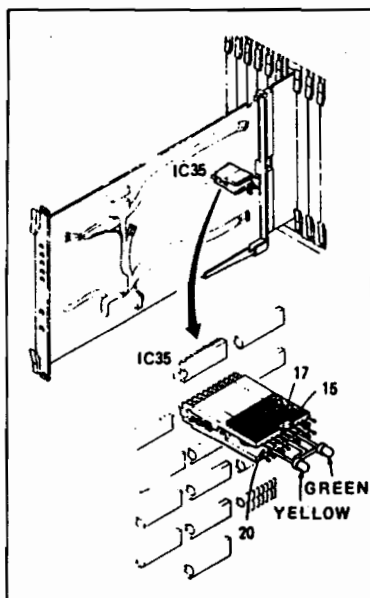
6.1.3 DRV-2 Board Adjustment

Required equipment: Digital DC voltmeter
Low tension jig (1) (jig #11)

Preliminary switch and control settings

Power switch: OFF

Use the extension board to access the SRVO board. Attach the low tension jig (1) to SRVO board IC35 with the LED facing upward, and slip the jig flush against pin 20.



SRVO board S2 (TEN SRV): OFF
Unplug CCB board CN104.
Turn the power ON.
Press the tension disarm switch.

Points of adjustment

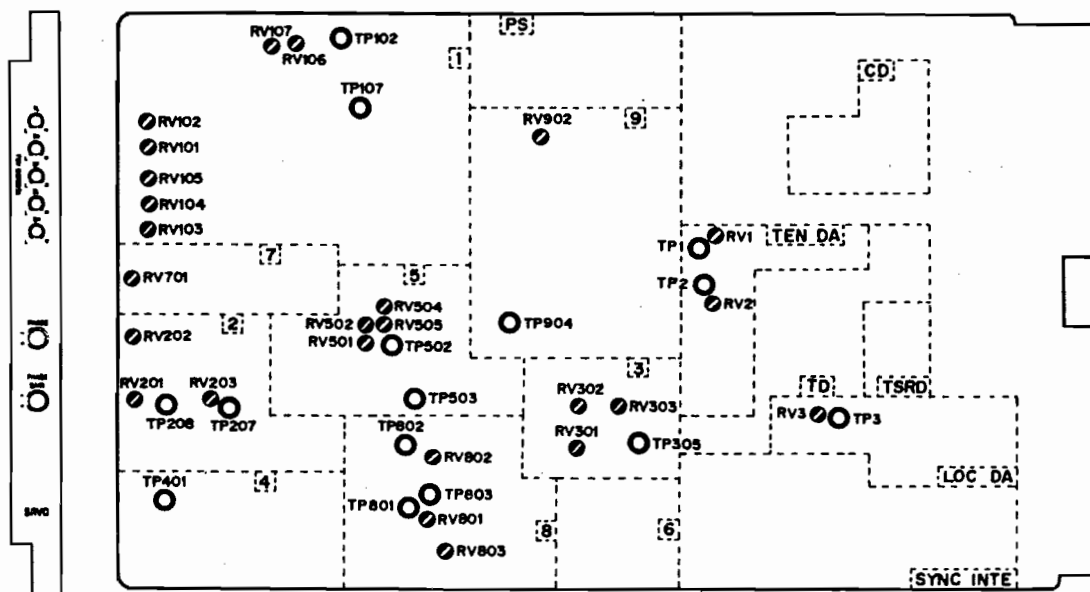
DRV-2 board: ●RV101

Adjustment procedure

1. IC offset adjustment
Specification: 2.75 mV DC $\pm$ 0.05 mV between TP3 and TP2 (GND)
Adjustment: ●RV101
2. Confirmation of reel motor rotation
Press the tension disarm switch to release the servo. Remove the low tension jig (1).
Turn on SRVO board switch S2 (TEN SRV).
Press the tension disarm switch.
Confirm the rotating direction of the S-side (clockwise) and T-side (counterclockwise), and shut off after about 0.5 seconds.

6.2 SRVO Board Adjustments

This section handles the electrical adjustments of the servo circuit board (SRVO board). These adjustments must be carried out after replacing the SRVO board or replacing components of the tape transport system.



SRVO Board - Component Side -
(No. 1-607-396-12)

6.2.1 SRVO Block 1 Adjustments

Required equipment: Oscilloscope

Low tension jig (1) (jig #11)

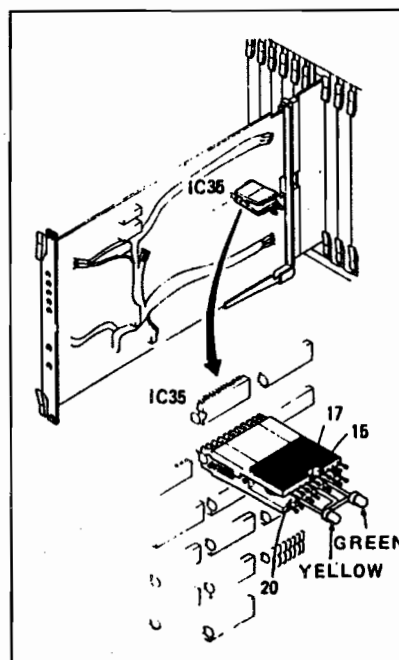
Low tension jig (2) (jig #12)

Points of adjustment

SRVO board: RV101, 102, 103, 104, 105, 106, 107

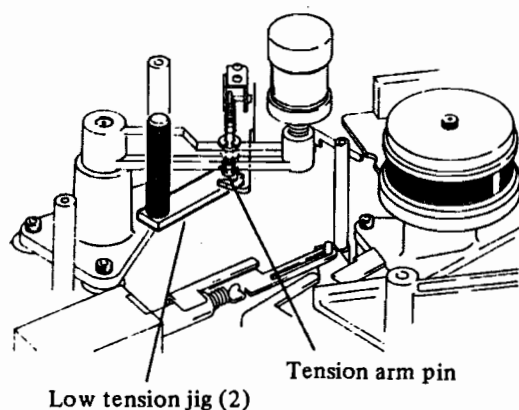
Adjustment procedure

1. IC offset adjustment
Turn the power ON.
Specification: 0 ± 10 mV DC at TP102 and TP106
Adjustment: RV106 (TP102) and RV107 (TP106)
2. Low tension detector adjustment
Conduct the "adjusting low tension detection" as directed in Section 5.7.2 "Adjusting the Tension Arms." Tension regulating potentiometer tentative adjustment
3. Preliminary switch and control settings
Use the extension board to access the SRVO board. Attach the low tension jig (1) to SRVO board IC35 with the LED facing upward, and slip the jig flush against pin 20.
SRVO board S2 (TEN SRV): OFF
Unplug CCB board CN104.



Turn power ON.
Press the tension disarm switch.
Attach the low tension jig (2) to S-side tension arm.

(S-side tension arm)

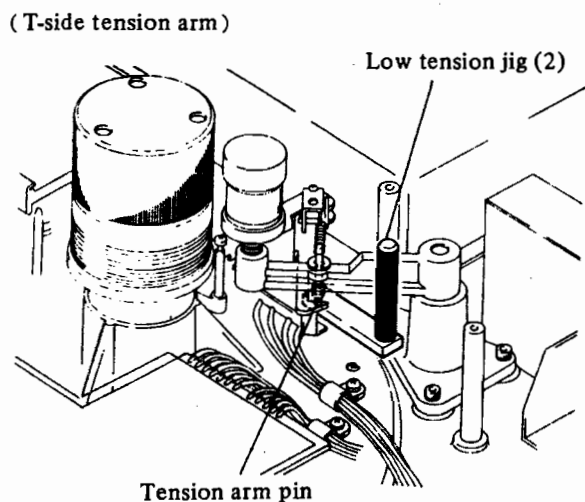


STOP mode
Specification: $-4.5V \pm 50 \text{ mV DC}$ at TP106
Adjustment: $\odot$ RV103

Slow forward mode
(Press PLAY and FF keys.)
Specification: $-4.5V \pm 50 \text{ mV DC}$ at TP106
Adjustment: $\odot$ RV105

Attach the low tension jig (2) to T-side tension arm.

(T-side tension arm)



STOP mode
Specification: $+5.5V \pm 50 \text{ mV DC}$
Adjustment: $\odot$ RV101

Slow reverse mode
(Press PLAY and REW keys.)
Specification: $+5.5V \pm 50 \text{ mV DC}$ at TP102
Adjustment: $\odot$ RV102

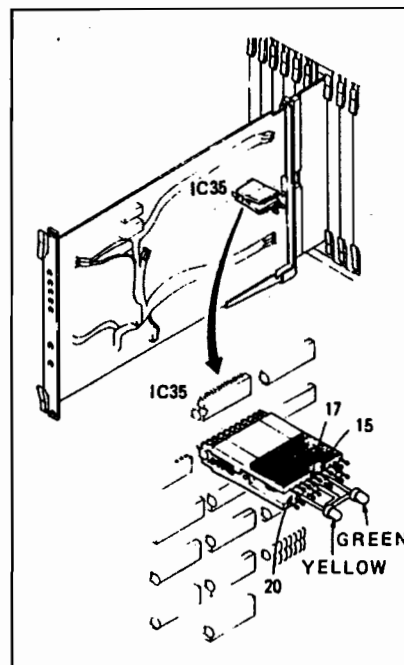
6.2.2 SRVO Block 1 Adjustments

Required equipment: Oscilloscope
Low tension jig (1) (jig #11)

Preliminary switch and control settings

Power switch: OFF

Use the extension board to access the SRVO board.
Attach the low tension jig (1) to SRVO board IC35 with the LED facing upward, and slip the jig flush against pin 20.



SRVO board S2 (TEN SRV): OFF
Unplug CCB board CN104.

Points of adjustment

SRVO board: $\odot$ RV201, 202, 203

Adjusting procedure

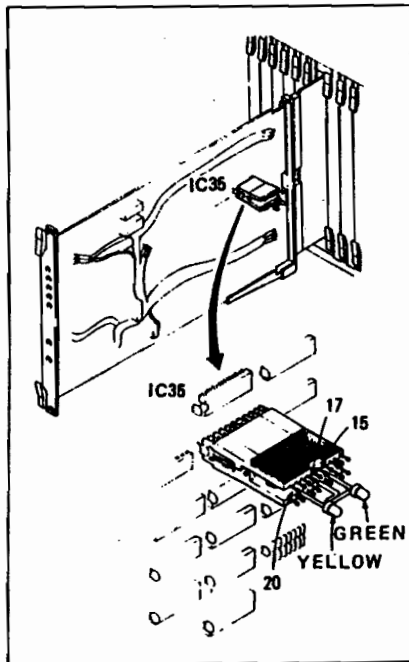
1. IC offset adjustment
Turn the power ON.
Press the tension disarm switch.
Short TP206 to E2.
Specification: $0 \pm 10 \text{ mV DC}$ at TP208
Adjustment: $\odot$ RV203
Unshort TP206 to E2.
2. Balance adjustment
Turn the power ON.
Press the tension disarm switch.
Set the sampling rate switch on the toggle switch panel to 44.1 kHz and conduct the adjustment, then to 48 kHz and conduct the adjustment.
Put the machine in the play mode.

Specification: The phase indicator on the CTL board should display its center value (the fifth and sixth, or the fifth or sixth, green LED should illuminate) in both the 44.1 kHz and the 48 kHz modes.
Adjustment: Adjust $\odot$ RV201 and $\odot$ RV202 alternately.

6.2.3 SRVO Block 3 Adjustments

Required equipment: Oscilloscope
Frequency counter
Low tension jig (1) (jig #11)

Preliminary switch and control settings
Power switch: OFF
Use the extension board to access the SRVO board.
Attach the low tension jig (1) to SRVO board IC35.



SRVO board S2 (TEN SRV): OFF
Unplug CCB board CN104.

Points of adjustment

SRVO board: ●RV301, 302, 303

Adjustment procedure

1. IC offset adjustment
Turn power ON.
Specification 0 ± 10 mV DC at TP305
Adjustment: ●RV303
2. FF speed adjustment
Turn the power ON.
Press the tension disarm switch.
Conduct the following adjustment while alternately putting the machine in the FF and REW mode:
Specification: frequency reading at TP401: $36.75 \text{ kHz} \pm 1.55 \text{ kHz}$ (35.2 to 38.3 kHz)
Adjustment: ●RV301
3. External phasing control speed adjustment
Turn the power ON.
Press the tension disarm switch.
Short pins 30 and 26 of the REMOTE 1 connector.
Specification: The phase indicator on the CTL board should display its center value (the fifth and sixth, or the fifth or sixth, green LED should illuminate, or the number of times the indicator fluctuates above or below the fifth and sixth segment does not exceed once per second).
Adjustment: ●RV302

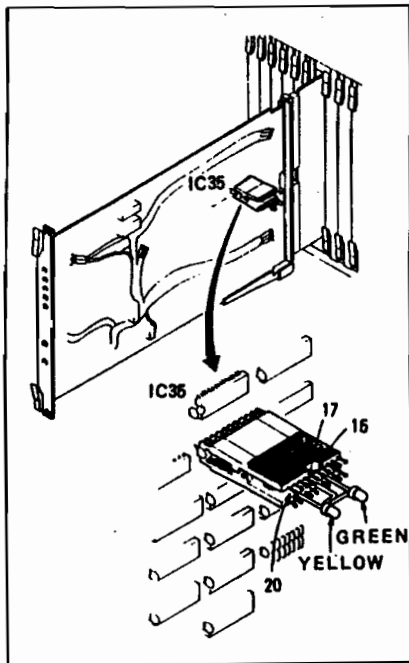
6.2.4 SRVO Block 5 Adjustments

Required equipment: Oscilloscope
Low tension jig (1)

Preliminary switch and control settings

Power switch: OFF

Use the extension board to access the SRVO board.
Attach the low tension jig (1) to SRVO board IC35 with the LED facing upward, and slip the jig flush against pin 20.



SRVO board S2 (TEN SRV): OFF
Unplug CCB board CN104.

Points of adjustment

SRVO board: RV501, 502, 503, 504, 505

Adjustment procedure

1. IC offset adjustment
Turn the power ON.
Specification: 0 ± 10 mV DC at TP503
Adjustment: RV501
2. FF/REW acceleration time adjustment
Turn the power ON.
Press the tension disarm switch.

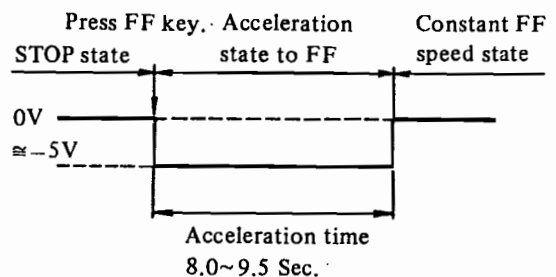
Adjust the time required to achieve standard speed from the stop state when the FF (REW) key is pressed:

Specification: FF/REW acceleration time at TP502:
8.0~9.5 sec.

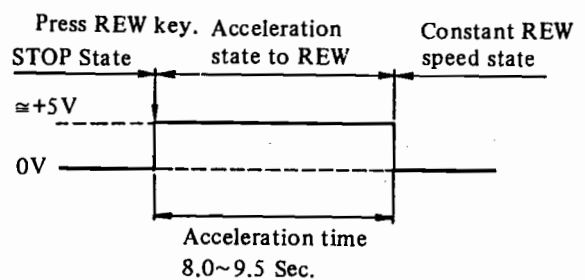
Adjustment: RV502

TP502 waveform

Acceleration from STOP to FF



Acceleration from STOP to REW



3. FF/REW deceleration time adjustment
Turn the power ON.
Press the tension disarm switch.

Press the FF (REW) key and allow the machine to achieve the constant FF (REW) speed, then adjust the time it takes to decelerate from this speed to a full stop when the STOP key is pressed:

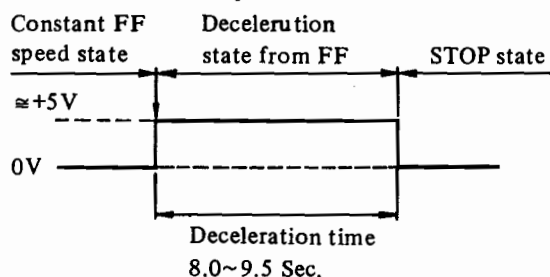
Specification: FF/REW deceleration time at TP502:
8.0~9.5 sec.

Adjustment: ⒶRV502

TP502 waveform

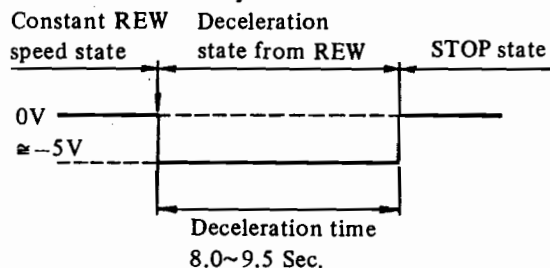
Deceleration from FF

Press STOP key.



Deceleration from REW

Press STOP key.



4. PLAY acceleration time adjustment
Turn the power ON.
Press the tension disarm switch.

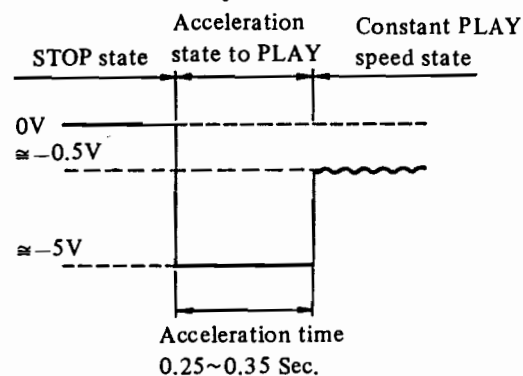
Adjust the time required to achieve standard speed from the stop state when the PLAY key is pressed:
Specification: PLAY acceleration time at TP502:
0.25~0.35 sec.

Adjustment: ⒶRV504

TP502 waveform

Acceleration from STOP to PLAY

Press PLAY key.



5. PLAY deceleration time adjustment
Turn the power ON.
Press the tension disarm switch.

Press the PLAY key and allow the machine to achieve the constant PLAY speed, then adjust the time it takes to decelerate from this speed to a full stop when the STOP key is pressed:

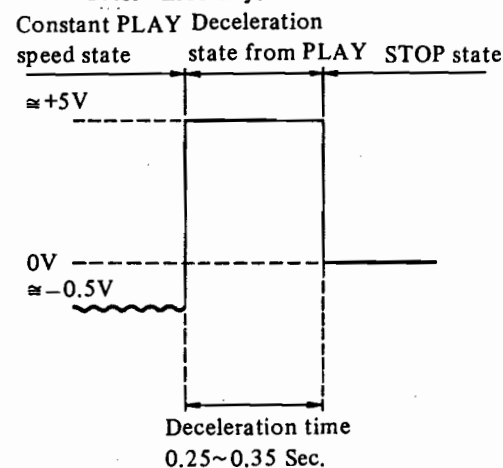
Specification: PALY deceleration time at TP502:
0.25~0.35 sec.

Adjustment: ⒶRV505

TP502 waveform

Deceleration from PLAY mode

Press PLAY key.



6.2.5 SRVO Block 7 Adjustments

Required equipment: Oscilloscope

Points of adjustment
SRVO board: ●RV701

Adjustment procedure

1. IC offset adjustment
Disconnect connector CN2 on the KY-3 board located under the control panel.
Turn the power ON.
Specification: 0 ± 10 mV DC at TP702
Adjustment: ●RV701
Reconnect CN2 of the KY-3 board.
2. Shuttle potentiometer position adjustment
See Section 5.2.2, "Adjusting the Shuttle Potentiometer Position."

6.2.6 SRVO Block 8 Adjustments

Required equipment: Oscilloscope

Points of adjustment
SRVO board: ●RV801, 802, 803

Adjustment procedure
IC offset adjustment
Turn the power ON.

Specification: 0 ± 10 mV DC at TP801
Adjustment: ●RV801

Note: Open the phase input terminal of the EXT SERVO CONTROL before making this adjustment.

Specification: 0 ± 10 mV DC at TP803
Adjustment: ●RV803

Hold down S2 on the CTL board while adjusting as follows:
Specification: 0 ± 10 mV DC at TP802
Adjustment: ●RV802

6.2.7 SRVO Block 9 Adjustments

Required equipment: Oscilloscope

Points of adjustment
SRVO board: ●RV901, 902

Adjustment procedure

IC offset adjustment
Turn the power ON.
Specification: 0 ± 10 mV DC at TP904
Adjustment: ●RV901

Specification: 0 ± 10 mV DC between E9 and the source terminal of Q909
Adjustment: ●RV902

Note: Open the phase input terminal of the EXT SERVO CONTROL before making this adjustment.

6.2.8 SRVO Board TEN DA Block Adjustments

Required equipment: Oscilloscope

Points of adjustment
SRVO board: ●RV1, 2

Adjustment procedure
IC offset adjustment
Turn the power ON.
Specification: 0 ± 10 mV DC at TP1
Adjustment: ●RV1
Specification: 0 ± 10 mV DC at TP2
Adjustment: ●RV2

6.2.9 SRVO Board LOC DA Block Adjustments

Required equipment: Oscilloscope

Points of adjustment
SRVO board: ●RV3

Adjustment procedure
IC offset adjustment
Turn the power ON.
Specification: 0 ± 10 mV DC at TP3
Adjustment: ●RV3

6.2.10 Overall SRVO Board Adjustments

The adjustments prescribed in this section are to be carried out after completing any of the adjustments described in Sections 6.2 to 6.2.9, or after replacing the SRVO board. However, the low tension detection adjustment described below need not be conducted a second time if the low tension detection adjustment prescribed in Section 6.2.1, "SRVO Block 1 Adjustment."

Required equipment: Oscilloscope
Wow-and-flutter meter
DC voltmeter

Low tension jig (1) (jig #11)
Low tension jig (2) (jig #12)
Tentelometer

Points of adjustment

SRVO board: ●RV201, 202, 302

Adjustment procedure

1. Low tension detection adjustment
Conduct the "Low tension detection adjustment" described in 5.7.2, "Adjusting the Tension Arms."
2. Main adjustment of the tension regulating potentiometer (tension adjustment)
Conduct the adjustments prescribed in Sections 5.7.3, "Adjusting Tape Tension," and 5.7.6, "Confirming the Set Tension."
3. CTL lock phase adjustment
Load a blank tape, put the machine in the ADVANCE REC mode, and record on all digital audio channels. Set the SAMPLING RATE switch (on the toggle switch panel) to 44.1 kHz, and to 48 kHz.

Specification: The phase indicator on the CTL board should display its center value (the fifth and sixth, or the fifth or sixth, green LED should illuminate) in both the 44.1 kHz and the 48 kHz modes.

Adjustment: Adjust ●RV201 and ●RV202 alternately.

4. External phasing control speed adjustment
Load any tape that has been recorded on in the ADVANCE REC mode.
Short pins 30 and 26 of the REMOTE 1 connector.

Specification: The phase indicator on the CTL board should display its center value (the fifth and sixth, or the fifth or sixth, green LED should illuminate, or the number of times the indicator fluctuates above or below the fifth and sixth segment does not exceed once per second).

Adjustment: ●RV302

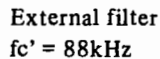
This section deals with the overall confirmation of the circuit boards connected with tape transport (SRVO, DRV-1, DRV-2, and HEA boards), and of the tape transport system mechanism.

Preliminary switch and control settings
Turn on switch no.3 of DIP SW1 on the ENC board (left most of the three boards).

Load a blank tape and record on all digital audio channels for about ten minutes in the ADVANCE RED mode. Play back the recorded section of tape and confirm the following:

wow and flutter at CH8 terminal P3 on the DET-1 board=0.3% or less (weighted, RMC, fc200 Hz, fourth LPF), and 0.2% or less (externally weighted, peak, fs88 kHz, primary LPF)

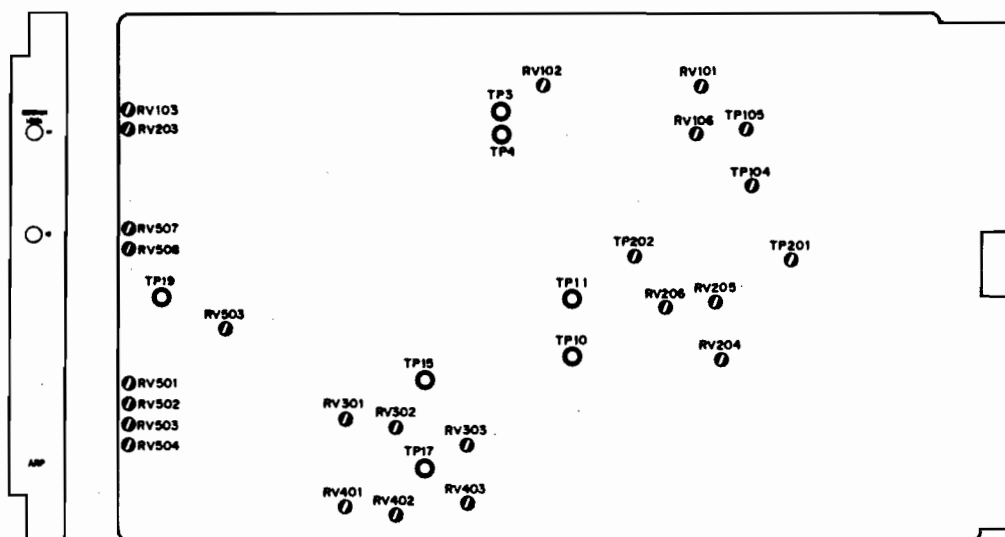
Note: See the wow-and-flutter block diagram below for details on fc and fc' .



6.4 ARP Board Adjustments

The ARP board adjustments entail making the electrical adjustments of the A1 and A2 analog track recording and playback system. These adjustments are necessary after the ARP board, the HBU, or the A/RP and A/E heads have been replaced, or when the electrical characteristics of the analog tracks deviate from specification.

Points of adjustment

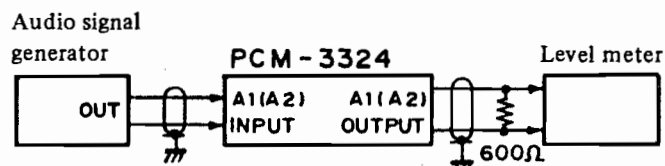


ARP Board - Component Side -
(No. 1-607-380-12)

6.4.1 Adjustments in the E-E Mode

Required equipment: Oscilloscope
Audio signal generator
Audio level meter

Connections



Preliminary switch and control settings
A1 and A2 monitor mode: INPUT

Points of adjustment

ARP board: RV102, 104, 105, 202, 204, 205, 301, 302, 303, 401, 402, 403, 505

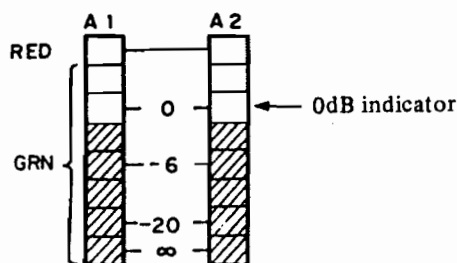
Adjustment procedure

1. Input balance adjustment

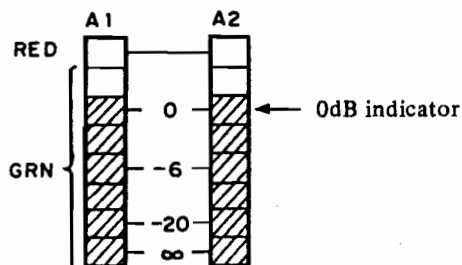
Specification: mechanical center (this adjustment is not required on machine with serial numbers of 11301 and higher; balance is achieved by means of a fixed resistor)

Adjustment: RV104, 204

2. Output balance adjustment
Set the A1 and A2 input levels to 1 kHz, +4 dBs (0 dBs=0.755V).
Specification: Amplitude of TP3 (channel A1) and TP10 (channel A2) must be equal to the amplitude of TP4 and TP11, respectively.
Adjustment: ●RV102 (A1), ●RV202 (A2)
3. Output balance adjustment
Set the A1 and A2 input levels to 1 kHz, +4 dBs
Specification: Output level at A1 and A2=24 dBs
Adjustment: RV105 (A1), RV205 (A2)
4. Meter amp adjustment
Set the A1 and A2 input levels to 1 kHz, +4 dBs.
Specifications: 3.8V DC at TP15 (A1) and TP17 (A2)
A1 and A2 input levels: 1 kHz, -16 dBs
Target values: 1.4V DC at TP15 (A1) and TP17 (A2)
Adjustment: Adjust ●RV301 and ●RV302 alternately for channel A1, and ●RV401 and ●RV402 alternately for channel A2.
5. Meter adjustment
Set the A1 and A2 input levels to 1 kHz, +2.7 dBs.
Specification: A1 (A2) level meter LEDs indicating 0 dB and above should all be out, and all negative-value indicators should be illuminated.



Set the A1 and A2 input levels to 1 kHz, +2.9 dBs.
Specification: A1 (A2) level meter 0 dB indicator LED and all negative-value indicators should be illuminated.
Adjustment: ●RV303 (A1), ●RV403 (A2)



6. Bias oscillator output adjustment
Specification: amplitude at TP19=8 V_{p-p}
Adjustment: ●RV505

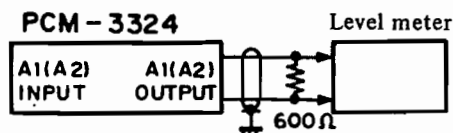
6.4.2 Adjustments in the PLAY Mode

Required equipment: Oscilloscope

Audio level meter

ARP adjustment reference tape (made by MRL 31L120, standard fluxivity: 200 nWb/m)

Connections



Preliminary switch and control settings
A1 and A2 monitor mode: REPRO

Points of adjustment

ARP board: ●RV101, 201

Adjustment procedure

Play back the 1 kHz reference level recorded on the ARP adjustment reference tape.

Specification: A1 and A2 output levels = +9 dBs (0 dBs=0.775V)

Adjustment: ●RV101 (A1), ●RV201 (A2)

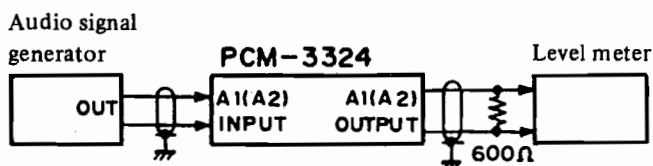
6.4.3 Adjustments in the REC Mode

Required equipment: Oscilloscope

Audio signal generator

Audio level meter

Connections



Preliminary switch and control settings
A1 and A2 monitor mode: REPRO

Points of adjustment

ARP board: ●RV106, 206, 501, 502, 503, 504, 507, 508

Adjustment procedure

1. Bias level adjustment

Set the A1 and A2 input levels to 1 kHz, +4 dBs (0 dBs=0.775V)

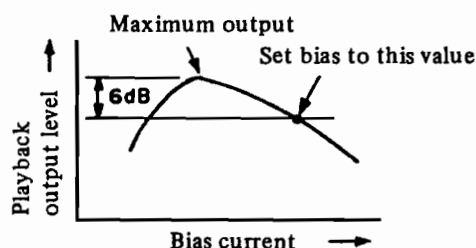
Record the signal on a blank tape, play back the recorded portion of the tape, and measure the playback output levels.

Repeat this process while gradually increasing the bias level.

Specification: set the bias value to the over-bias point 6 dB lower than maximum output

Adjustment: ⌚RV507 (A1), ⌚RV508 (A2)

The bias level is increased by turning the RVs clockwise.



2. Record level adjustment

Set the A1 and A2 input levels to 1 kHz, +4 dBs
Record the signal on a blank tape and play back the recorded section of tape.

Specification: A1 and A2 output levels=+4 dBs

Adjustment: ⌚RV106 (A1), ⌚RV206 (A2)

3. Erase current adjustment

Set the A1 and A2 input levels to 1 kHz, +20 dBs, and to no-signal input

Record the +20 dBs signal onto a section of blank tape, then record the no-signal input onto the same section.

Specification: erasing efficiency = min. 50 dB

Adjustment: ⌚RV501 (A1), ⌚RV503 (A2)

Record the +20 dB signal onto a blank tape and play back the recorded section. Repeat this operation while making the following adjustment until the specification is achieved.

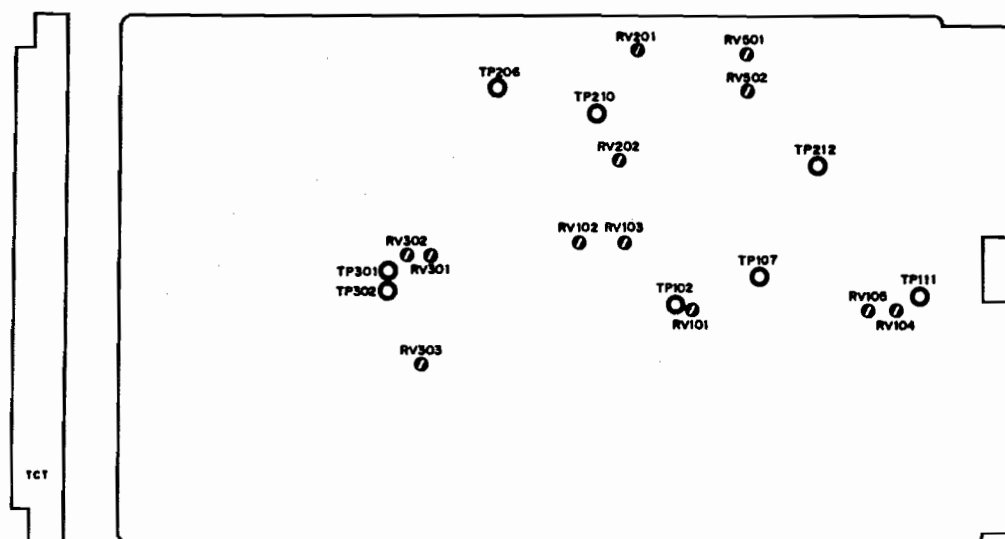
Specification: distortion factor = minimum

Adjustment: ⌚RV502 (A1), ⌚RV504 (A2)

6.5 TCT Board Adjustments

TCT board adjustments entail the electrical adjustment of the time code track recording and playback system. These adjustments are required when the TCT board, the HBU, or the A/RP head has been replaced, or when the electrical characteristics of the time code track no longer conform to specification.

Points of adjustment

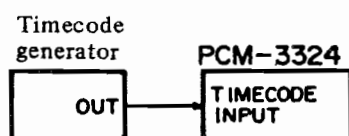


TCT Board -- Component Side --
(No. 1-608-297-12)

6.5.1 Adjustments in the REC mode

Required equipment: oscilloscope
Time code generator

Connections



Preparatory switch and control settings
Time code monitor mode: REPRO or INPUT

Points of adjustment

TCT board: RV101, 102, 103, 104, 301

Adjustment procedure

1. Input gain adjustment
Set the time code input level to SMPTE or EBU time code, 5 V_{p-p}.

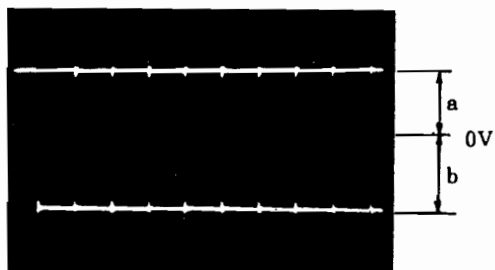
Specification: amplitude at TP102: 5 V_{p-p}
Adjustment: RV101



2. Recording current offset adjustment
Set the time code input level to SMPTE or EBU time code, 5 Vp-p.
Record the signal onto a blank tape in the ADVANCE REC mode.

Specification: In the waveform shown below, $a=b$, at TP107

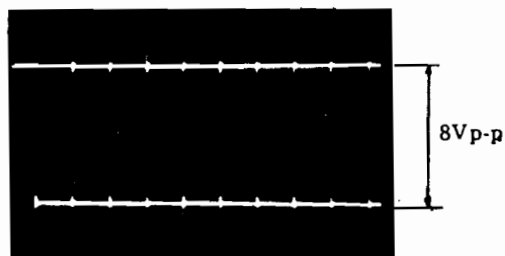
Adjustment: ⌚RV102



3. Recording current gain adjustment
Set the time code input level to SMPTE or EBU time code, 5 Vp-p.
Record the signal onto a blank tape in the ADVANCE REC mode.

Specification: amplitude of TP107=8 Vp-p

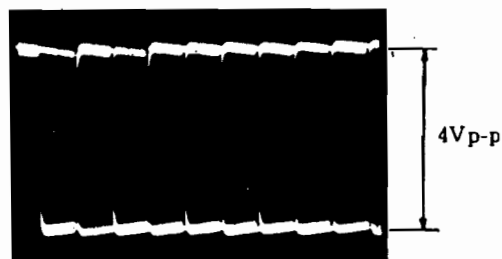
Adjustment: ⌚RV103



4. Meter amp adjustment
Set the time code input level to SMPTE or EBU time code, 5 Vp-p.
Record the signal onto a blank tape in the ADVANCE REC mode.

Specification: amplitude of TP301=4 Vp-p

Adjustment: ⌚RV301



5. Erasing current adjustment
Adjustment (1)
Set the time code input level to SMPTE or EBU time code, 5 Vp-p.
Record the signal onto a blank tape in the ADVANCE REC mode.

Specification: TP111=2.5V DC

Adjustment: ⌚RV104

Adjustment (2)

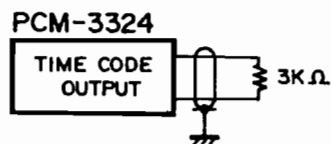
Rotate ⌚RV105 completely counterclockwise.

6.5.2. Adjustments in the PLAY mode

Required equipment: oscilloscope

Tape: After completing the recording mode adjustments described in 6.5.1, use the tape onto which the signal was recorded at step two.

Connections



Preliminary switch and control settings

Time code monitor mode: REPRO

Points of adjustment

TCT board: ●RV201, 202, 203, 302, 303

Adjustment procedure

1. Input gain adjustment
Play back the recorded tape.
Specification: amplitude at TP206=14 V_{p-p}
Adjustment: ●RV201



2. Output gain adjustment
Play back the recorded tape.
Specification: amplitude at TP210=2 V_{p-p}
Adjustment: ●RV202
3. Output balance adjustment
Play back the recorded tape.
Specification: amplitude at TP212=4 V_{p-p}
Adjustment: ●RV203

Note: This adjustment is not necessary for TCT boards no. 1-608-297-12 and higher (on machines, serial no. 10501 and higher); balance is achieved by means of a fixed resistor.

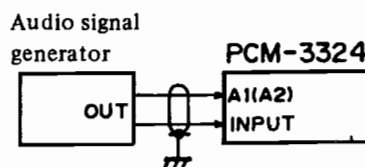
4. Meter amp adjustment
Play back the recorded tape.
Specification: amplitude at TP302=4 V_{p-p}
Adjustment: ●RV302
5. Meter display adjustment
Play back the recorded tape.
Specification: Time code level meter should display 0.
Adjustment: ●RV303

6.5.3 Analog Track Signal Crosstalk Adjustment

Required equipment: oscilloscope

Audio signal generator

Connections



Preliminary switch and control settings

Time code monitor mode: REPRO

Points of adjustment

TCT board: ●RV501, 502

Adjustment procedure

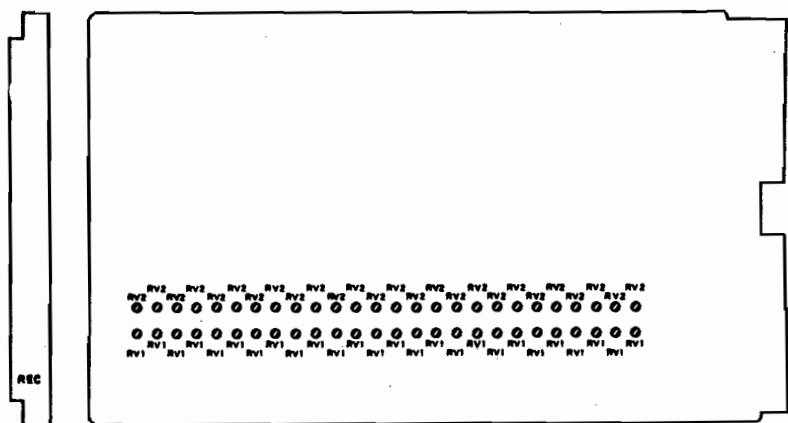
Set the A1 and A2 input levels to 1 kHz, +10 dBs (0 dBs=0.775V). Input the signal one channel at a time. Record the A1 channel (and later the A2 channel) signal onto a blank tape.

Specification: amplitude at TP206=minimum
Adjustment: ●RV501(A1), ●RV502(A2)

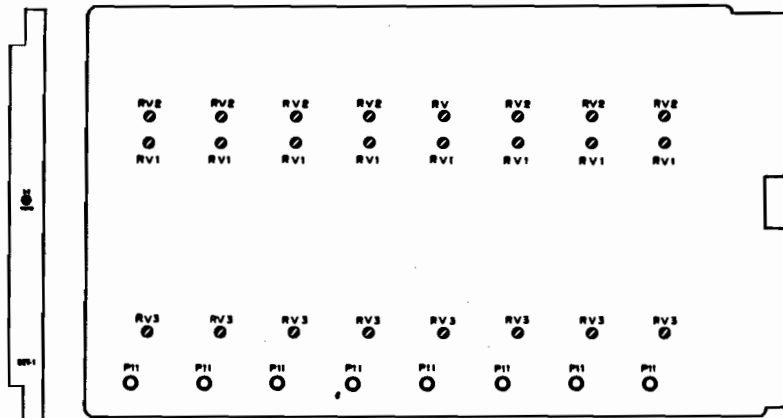
6.6 REC, DET, and CTL Board Adjustments (Adjustment of the Digital Track Record and Playback System)

The adjustments covered in this section entail the electrical adjustment of the digital audio track and the CTL track recording and playback system. These adjustments must be carried out after the REC board, the DET board, the CTL board, the HBU, or the D/ADV REC, D/SYNC REC, and D/PB heads have been replaced.

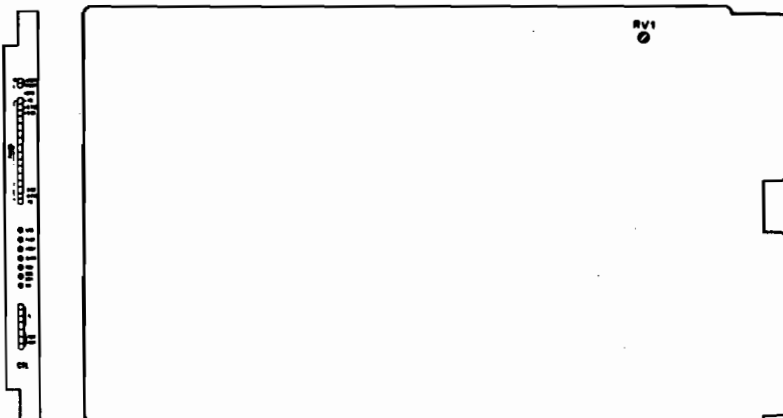
Points of adjustment



REC Board — Component Side —
(No. 1-607-366-12)



DET Board — Component Side —
(No. 1-607-368-14)



CTL Board — Component Side —

Table of Digital Track Recording and Playback System Adjustments

Section	Adjustment Item		Switch settings, etc.	Location of adjustment		Specification
				Board	adjusting part	
6.6.1 1.	Digital audio track	Tentative adjustment of the recording current amplitude (digital audio track)	Standard recording blank tape 3 ENC jigs, with S1 1 and 2 set to ON MCPU board, SW3 5:OFF Record only the channel to be recorded in ADVANCE REC mode.	REC	RV2	Amplitude of DET board P3 must be maximum, and the peak of the waveform must be as sharp as possible.
6.6.1 2.		Fine adjustment of the recording current amplitude (digital audio track)		REC	RV2	Amplitude of REC board $P3 = V_{Tx}^{100}$ _a
6.6.1 3		Recording current offset adjustment (digital audio track)		REC	RV1	Voltage at REC board $P3 = 0mV \pm 10mVdc (\pm 20mVdc \text{ when checking and inspecting})$ (PC-433 filter jig output)
6.6.2 1.	Digital audio track	Playback system equalizer adjustment (digital audio track)	Standard recording blank tape ENC board : normal mode EDT B board S4 (PN GEN) : TEST DITHER SW : ON Record all channels in ADVANCE REC mode.	DET	RV1 RV2	Minimum jitter in zero-cross points of DET board P11 eye pattern
6.6.2 2		Playback system offset adjustment (digital audio track)		DET	RV3	Voltage at DET board $P11 = +25mV \pm 10mVdc$ ($\pm 20mVdc$ when checking and inspecting) (PC-433 filter jig output)
6.6.1 4	CTL track	Recording current adjustment (CTL track)	ADVANCE REC	REC	RV2	Amplitude of REC board $P3 = 4Vp-p$
		Amplitude adjustment Offset adjustment		REC	RV1	Positive and negative values of REC board P3 amplitude must match.
6.6.3	CTL track	Playback level adjustment (CTL track)		CTL	RV1	CTL level meter indication $= 0^{+2}_{-1}$ segment

6.6.1 REC Board Adjustments (Digital Track Recording Current Adjustment)

After completing this adjustment, be sure to make the adjustments prescribed in 6.6.2, "DET Board Adjustments," or in 6.6.3, "CTL Board Adjustments."

Required equipment: oscilloscope
DC voltmeter

ENC jig boards (3)
Filter jig PC-433
Standard recording blank tape (CID-1/2A)

Preliminary switch and control settings

Set switches no. 1 and 2 of DIP SW1 on the ENC jig boards to the ON position (the TEST-1 LED on the ENC jig board will illuminate to show that the 384 kHz, $f_s=48$ kHz rectangular waveform is being generated). Set switch no. 5 of DIP SW3 on the MCPU board to the ON position.

Points of adjustment

REC board: $\odot$ RV1, 2

Adjustment procedure

1. Tentative adjustment of the digital audio track recording current amplitude
Load the standard recording blank tape and record only the channels to be adjusted, in the ADVANCE REC mode.
Specification: The amplitude of terminal P3 of the DET board must be maximum, and the waveform must be as sharp as possible.
Note: Adjust the oscilloscope's vertical sensitivity to maximum to blow up the peak of the P3 waveform so the peaks can be observed more closely.

Adjustment: $\odot$ RV2



Make as sharp as possible.

Peak of P3 waveform

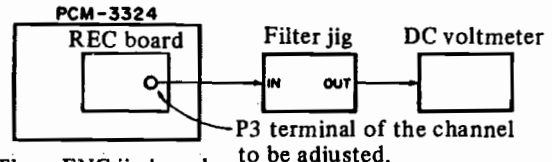
2. Fine adjustment of the digital audio track recording current amplitude
Observe the amplitude of P3 terminals on the REC board of the channel to be adjusted.
Specification: amplitude at P3 of REC board of the channel to be adjusted $= V_T \times \frac{100}{\alpha}$ where:
 V_T : amplitude of P3 when the above tentative adjustment was made.
%: saturated recording current, characteristic of the standard recording blank tape (value near 100%)
Adjustment: $\odot$ RV2 on REC board

3. Digital audio track recording current offset adjustment

Preliminary switch and control settings

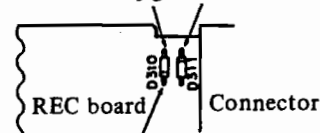
ENC jig boards (3), DIP switch SW1, switches no.1 and 2: ON
Three ENC jig boards, TEST-1 LED lights up and the rectangular pulse (384 kHz, $f_s=48$ kHz) will generate.

Connections



(Three ENC jig boards attached)

Connect to the -15V terminal of the Filter jig. Connect to the +15V terminal of the filter jig.



Connect to the GND terminal of the Filter jig.

Notes:

Connect the power supply terminals ($\pm 15V$) of the filter jig as illustrated above. Make connections with the PCM-3324 power switch turned OFF. Allow about ten minutes to pass after turning the PCM-3324 power ON before beginning with the adjustment.

Load the standard recording or any other blank tape and record in the ADVANCE REC mode only the channels to be adjusted.

Specification: Filter jig output: $0\text{ mV} \pm 10\text{ mV DC}$ (when re-adjusting); $0\text{ mV} \pm 20\text{ mV DC}$ (when verifying or inspecting). (Adjust the filter jig output as finely as possible to eliminate error.)

Adjustment: $\odot$ RV1 of the REC board.

Note:

Be sure to use the PC-433 filter jig, the adjustment specification of $-50\text{ mV} \pm 10\text{ mV DC}$ on the old type of jig corresponds to the $0\text{ mV} \pm 10\text{ mV DC}$ specification of the PC-433, which has a different circuit configuration from the old jig.

4. CTL track recording current adjustment
Load the standard recording or any other blank tape and record in the ADVANCE REC mode.

Amplitude adjustment

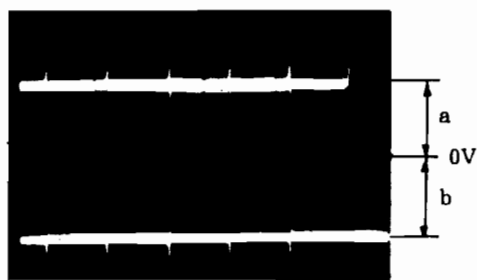
Specification: amplitude of the CTL P3 terminal on the REC board = v_4 V_{p-p}

Adjustment: REC board CTL ⓪RV2

Offset adjustment

Specification: The waveform of the REC board CTL terminal P3 should be as shown below, with $a=b$.

Adjustment point: REC board CTL ⓪RV1



6.6.2 DET Board Adjustments (Digital Audio Track Playback System Adjustment)

Conduct these adjustments only after having completed the adjustments prescribed at 6.6.1 on the REC boards.

Required equipment: oscilloscope
DC voltmeter

Filter jig PC-433

Standard recording blank tape (D1D-1/2AJ)

Preliminary switch and control settings

ENC boards (3), DIP switch S1, switches no. 1-8: OFF

EDT B board, switch S4 (PN GEN): TEST

DITHER switch: ON

Points of adjustment

DET board: ⓪RV1, 2, 3

Adjustment procedure

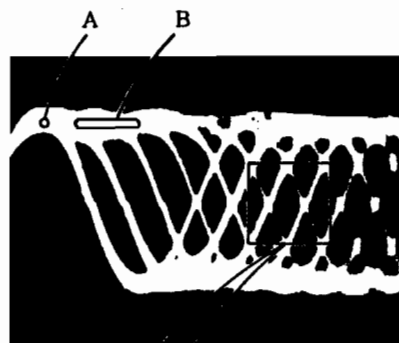
1. Equalizer adjustment

Load the standard recording blank tape and record all 24 channels in the ADVANCE REC mode.

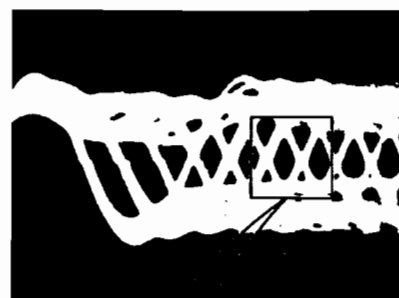
Specification: Minimize the jitter at the zero cross points of the eye pattern monitored at P11 (DET board) of the channel to be adjusted (see detailed description, below).

Adjustment: DET board RV1 and RV2

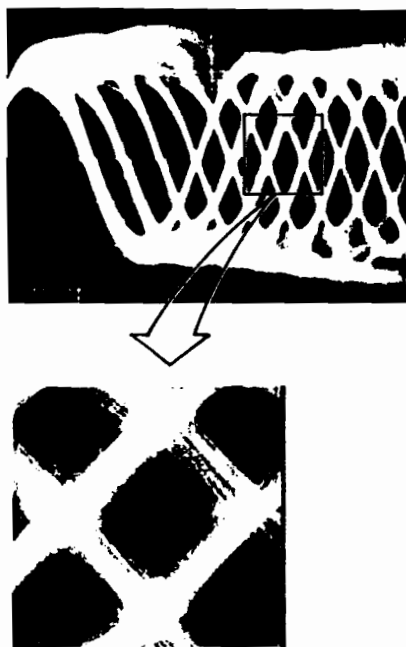
(1) Proper equalizer adjustment



(2) Overcompensated equalizer adjustment



(3) Undercompensated equalizer adjustment

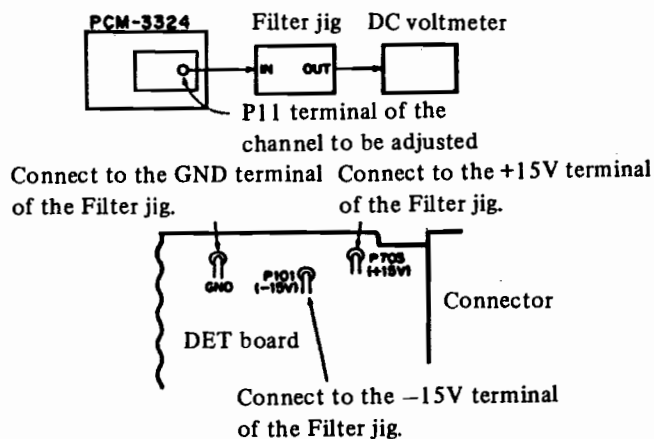


Detailed description of equalizer adjustment procedure

- (1) Adjust RV1 and RV2 little by little, alternately, to tentatively adjust the waveform of DET board P11 so that it becomes like the waveform shown in Photo 1.
- (2) Carefully rotate RV1 slightly to obtain an overcompensated waveform as shown in Photo 2.
- (3) Adjust RV2 to sharpen the section indicated by A in Photo 1.
- (4) Adjust RV1 so that the section indicated by B in Photo 1 becomes flat.
- (5) Finely adjust RV1 and RV2 alternately to reduce jitter at the zero cross points of the eye pattern as much as possible.

2. Offset adjustment

Connections



Notes

- Connect the power supply terminals (15V) of the filter jig as illustrated above. Make connections with the PCM-3324 power switch turned OFF.
- Allow about ten minutes to pass after turning the PCM-3324 power ON before beginning with the adjustment.

Load the standard recording blank tape and record all 24 digital audio channels in the ADVANCE DET mode.

Specification: Filter jig average output: +25 mV 10 mV DC (when adjusting); +25 mV 20 mV DC (When verifying or inspecting). (Adjust the filter jig output as finely as possible to eliminate error.)

Adjustment: RV3 of the DET board.

6.6.3 CTL Board Adjustments (CTL Track Playback Adjustments)

Conduct these adjustments only after having completed the adjustments prescribed at 6.6.1 on the REC boards.

Point of adjustment

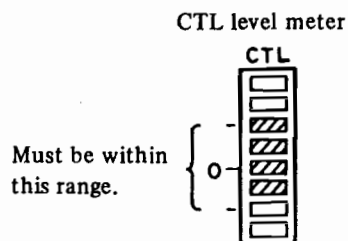
CTL board: RV1

Adjustment procedure

Load the standard recording or any other blank tape and record in the ADVANCE REC mode.

Specification: CTL level meter must display a value in the range of 0 - 1/+2 (see illustration)

Adjustment: RV1

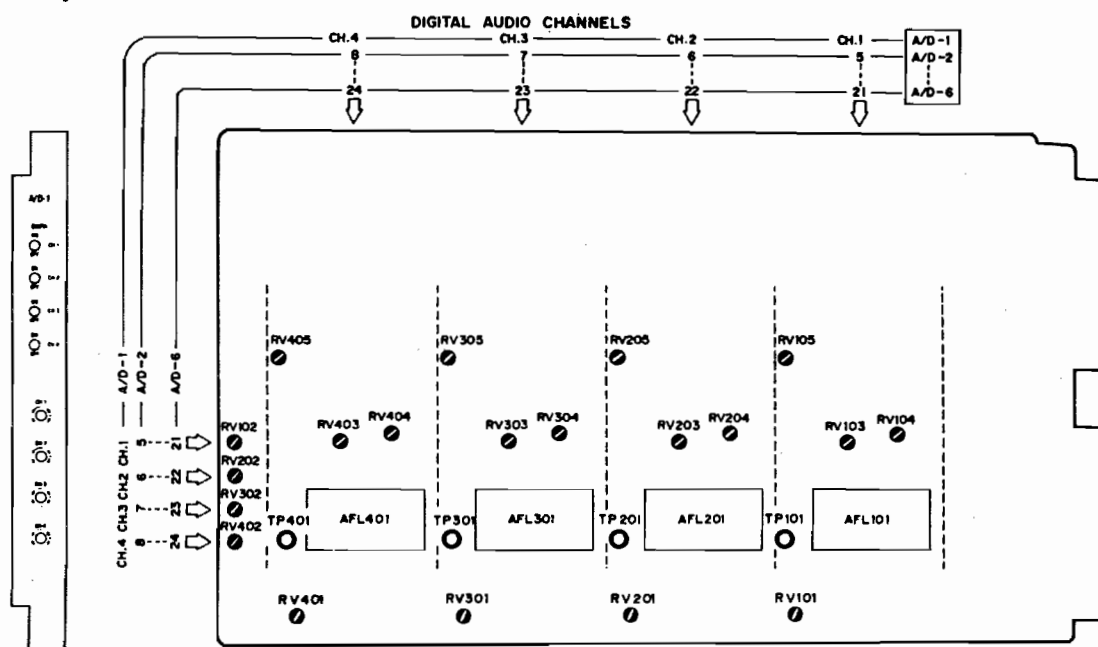


6.7 A/D and D/A Board Adjustments and Confirmation

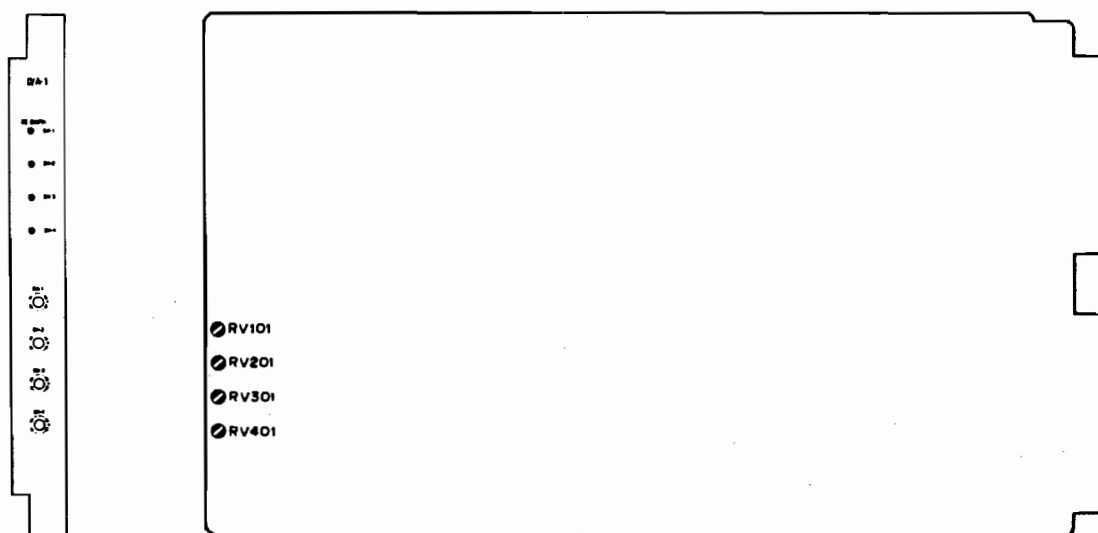
This section deals with the electrical adjustments of the A/D and D/A conversion system. These adjustments must be carried out following the replacement of any analog semi-conductors or converter chips on the A/D board or the D/A board.

The instructions in this section have been written on the assumption that input level settings are the factory settings. It is therefore necessary, when the factory settings have been altered, to reset the input levels to their original settings before beginning these adjustments.

Points of adjustment



A/D Board —Component Side—
(No. 1-607-393-13)

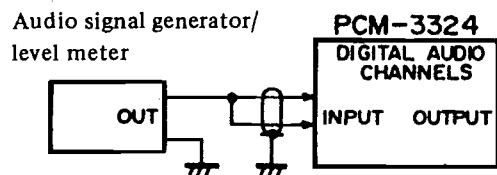


D/A Board —Component Side—
(No. 1-607-394-12)

6.7.1 CMRR (Common Mode Rejection Ratio) Adjustment (A/D Board)

Required equipment: Audio signal generator
Audio level meter (or an oscilloscope)

Connections



Note: Apply the same amplitude and phase signals to the HOT and COLD lines of the PCM-3324 INPUT.

Points of adjustment

A/D board: RV101, 201, 301, 401

Adjustment procedure

DIGITAL AUDIO CHANNEL input levels: +18 dBs (0 dBs=0.775V), 10 kHz, with GND as reference.

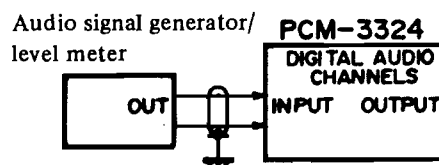
Connect the audio level meter (or oscilloscope) to the following TP terminals and adjust each one to specification: Specification: amplitude of TP101, TP201, TP301, & TP401=0

Adjustment point: RV101, 201, 301, 401, respectively.

6.7.2 Input Level Adjustment (A/D Board)

Required equipment: Audio signal generator
Audio level meter

Connections



Preliminary switch and control settings

Digital audio channel monitor mode: INPUT

Input select switch on the toggle switch panel: ANALOG

Emphasis switch: ON

On the EDT B board:

6 dB/SEG/NORM switch: NORM

DOUBLE IND/CAL FLASH switch: CAL FLASH

TEST/NORM switch: NORM

HPF switch: ON

DITHER: ON

Point of adjustment

A/D board: RV102, 202, 302, 402

Adjustment procedure

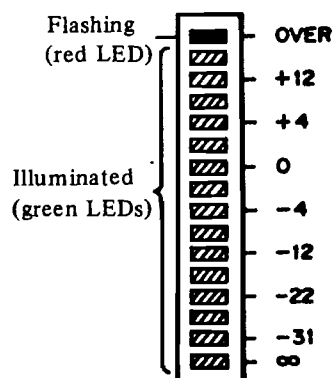
Digital audio channel input levels: +24 dBs, 1 kHz (0 dBs=0.775V)

Specification: OVER indicator (red LED) of the digital audio channel level meter should flash.

Adjustment point: RV102, 202, 302, and RV402 of the channel being adjusted.

Note: The input level given above is the factory-set level. The maximum input level can be altered to conform to the output level of the signal generator.

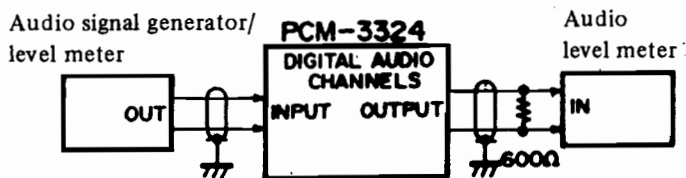
Digital audio channel level meter



6.7.3 Output Level Adjustment (D/A Board)

Required equipment: Audio signal generator
Audio level meter

Connections



Preliminary switch and control settings
Digital audio channel monitor mode: INPUT
Input select switch on the toggle switch panel: ANALOG
Emphasis switch: ON
EDT B board HPF switch: ON
DITHER switch: ON

Points of adjustment
D/A board: RV101, 201, 301, 401

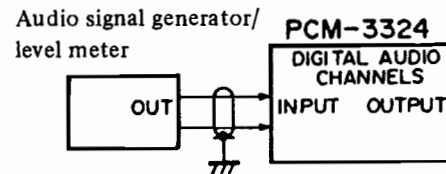
Adjustment procedure

Input level of digital audio channels: 1 kHz, +24 dBs (0 dBs=0.775V)
Specification: Output level of digital audio channels: +24 dBs
Adjustment: RV101, 201, 301, and RV401 of the channels to be adjusted.

6.7.4 A/D Board Emphasis Function Confirmation

Required equipment: Audio signal generator
Audio level meter

Connections

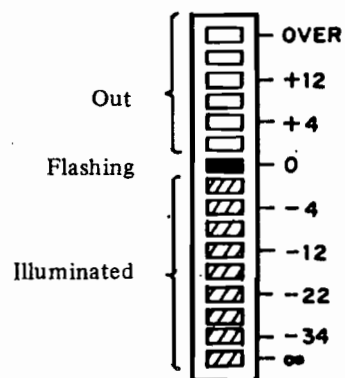


Preliminary switch and control settings
Digital audio channel monitor mode: INPUT
Input select switch on the toggle switch panel: ANALOG
EDT B board switches:
6 dB/SEG/NORM switch: NORM
DOUBLE IND/CAL FLASH switch: CAL FLASH
TEST/NORM switch: NORM
HPF switch: ON
DITHER switch: ON

Adjustment procedure

- (1) Turn ON the EMPHASIS switch, located on the toggle switch panel.
- (2) Input level of digital audio channels: 1 kHz, +4 dBs (0 dBs=0.775V)
Confirm: that the 0 dB indicator LED (green) of the digital audio level meter flashes.

Digital audio channel level meter



- (3) Change the frequency of the digital audio channel input signal to 10 kHz without changing the input level (+4 dB).
Confirm: that the digital audio level meter indicates +4 dB (all indicator LEDs (green) up to the +4 dB segment illuminated).

6.7.5 A/D Converter Offset Adjustment (A/D Board) Preliminary switch and control settings

NORM/VARI SPEED switch (on the control panel):
NORM

Toggle switch panel switches:

Input select switch: ANALOG

Emphasis switch: ON

EDT B board switches:

6 dB/SEG/NORM switch: NORM

TEST/NORM switch: NORM

HPF switch: OFF

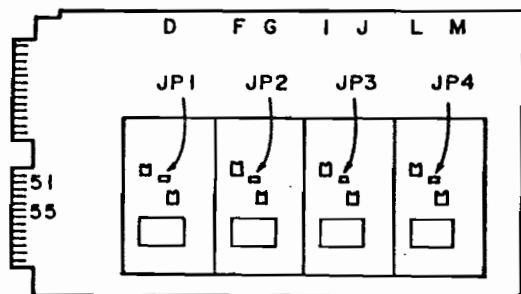
Points of adjustment

A/D board: RV103, 203, 303, 403

Adjustment procedure

1. A/D boards No. 1-607-393-13 and higher (PCM-3324 serial no. 11601 and higher)

Open the solder bridges JP1~JP4 located on the solder-pattern side of the A/D board (releases the offset automatic adjusting function).



A/D Board(1-607-393-13)

Solder side

Specification: Only the (infinity) LED of the digital audio channel level meter should be illuminated.

Adjustment: RV103, 203, 303, and RV403 of the channels to be adjusted.

After completing the adjustment, re-solder the solder bridges J1~J4.

2. A/D boards No. 1-607-393-11 and 1-607-393-12 (PCM-3324s up to serial no. 11600)

Specification: Only the (infinity) LED of the digital audio channel level meter should be illuminated.

Adjustment point: RV103, 203, 303, and RV403 of the channels to be adjusted.

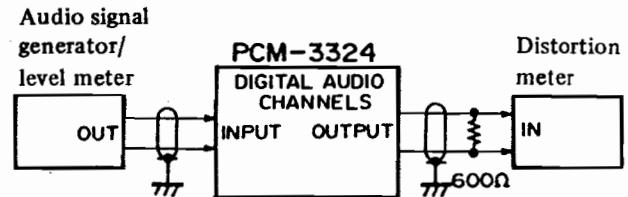
6.7.6 Distortion Adjustment (A/D Board)

The input level must conform to the specification prescribed in Section 6.7.2, "Input Level Adjustment (A/D Board)," when this adjustment is conducted.

Required equipment: Audio signal generator
Audio level meter

Distortion meter

Connections



Preliminary switch and control settings

Digital audio channel monitor mode: INPUT

Toggle switch panel switches:

Input select switch: ANALOG

Emphasis switch: ON

EDT B board switches:

6 dB/SEG/NORM switch: NORM

DOUBLE IND/CAL FLASH switch: CAL

FLASH

TEST/NORM switch: NORM

HPF switch: ON

DITHER: ON

Points of adjustment

A/D board: RV104, 105, 204, 205, 304, 305, 404, 405

Adjustment procedure

Input level of digital audio channels: 1 kHz, +23.5 dBs (0 dBs=0.775V)

Specification: minimum digital audio channel output distortion

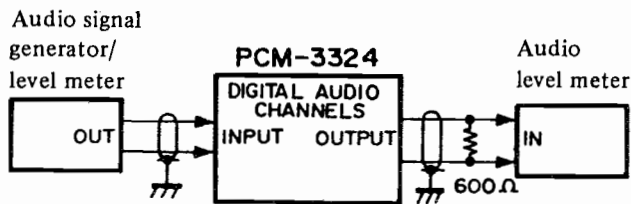
Adjustment: RV104, & 105, RV204 & 205, RV304, & 305, RV404 & 405 of each AD board. Adjust alternately the RVs of the RV pair for each channel.

6.7.7 Noise Ratio Confirmation

The input and output levels must conform to the specifications prescribed in Sections 6.7.2, "Input Level Adjustment (A/D Board)," and 6.7.3, "Output Level Adjustment (A/D Board)," when this adjustment is conducted.

Required equipment: Audio signal generator
Audio level meter

Connections



Note: Measure only the 30kHz and lower level ranges with the level meter.

Note: Measure only the 30 kHz and lower level ranges with the level meter.

Preliminary switch and control settings
Digital audio channel monitor mode: INPUT
Toggle switch panel switches:
Input select switch: ANALOG
Emphasis switch: ON
EDT B board switches:
TEST/NORM switch: NORM
HPF switch: ON
DITHER switch: ON

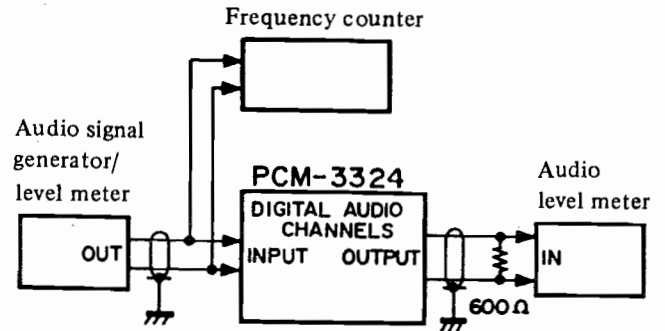
Adjustment procedure

- (1) Digital audio channels input level:
 ± 24 dBs (0 dBs=0.775V), 1 kHz
Confirm that the output levels of the same channels are +24 dBs, when an input level of +24 dBs, 1 kHz is applied.
- (2) Disconnect the input, short the HOT and COLD input terminals, and measure the digital audio channel output residual noise levels (dBs).
Confirm: +24 dBs - residual noise level (dBs) > 90 dB

6.7.8 Frequency Characteristic Confirmation

Required equipment: Audio signal generator
Audio level meter
Frequency counter

Connections

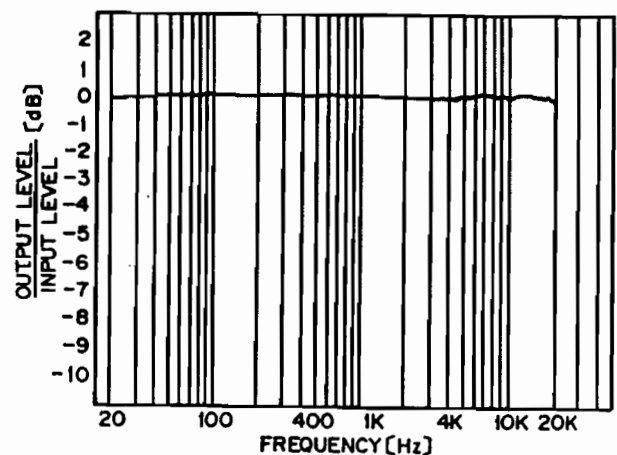


Preliminary switch and control settings
Digital audio channel monitor mode: INPUT
Input select switch on the toggle switch panel: ANALOG
EDT B board switches:
TEST/NORM switch: NORM
HPF switch: ON
DITHER: ON

Adjustment procedure

With EMPHASIS switch OFF

- (1) Turn OFF the emphasis switch located on the toggle switch panel.
- (2) Digital audio channels input level:
+4 dBs (0 dBs=0.775V), 1 kHz
Measure the output levels of the same channels when the input level of +4 dBs, 1 kHz is applied, and make this level as the output reference level.
- (3) Vary only the frequency of the input signal as directed below, and measure the output level for each frequency:
Input frequencies: 20, 40, 100, 400, 4k, 7k, 9k, 10k, 12k, 15k, 17k, 19k, 20k (Hz)
Confirm: Output level, as measured against the output reference level 20 Hz, - 20 kHz: within +0.5/-1.0 dB



With EMPHASIS switch ON

- (1) Turn ON the emphasis switch located on the toggle switch panel.
- (2) Measure the output levels of the digital audio channels when an input level of 4 dBs, 1 kHz (0 dBs=0.775V) is applied; take the measured level as the output reference level.
- (3) Vary only the frequency of the input signal as directed below and measure the output level for each frequency:
Input frequencies: 20, 40, 100, 400, 4k, 7k, 9k, 10k, 12k, 15k, 17k, 19k, 20k (Hz)
Confirm: Output level, as measured against the output reference level, 20 Hz, — 20 kHz: within +0.5/–1.0 dB

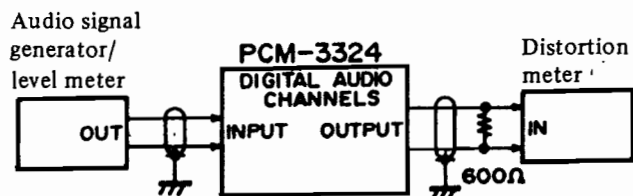
6.8 Power Supply Block Adjustments and Checks

The PCM-3324's power supply block handles very high voltages and electric currents. Never operate the power supply block while any of its circuit boards are removed. Doing so can cause serious injury (electrocution) to personnel, and may also lead to irreparable damage to components. Furthermore, only the power supply board checker designed specifically for the purpose should be used for adjusting and checking the power block. Detailed instructions on power block adjustments and checks are given in the power supply board checker's operation manual.

6.7.9 Distortion Confirmation

Required equipment: Audio signal generator
Audio level meter
Distortion meter

Connections



Preliminary switch and control settings

Digital audio channel monitor mode: INPUT

Input select switch on the toggle switch panel: ANALOG

EDT B board switches:

TEST/NORM switch: NORM

HPF switch: ON

DITHER: ON

Adjustment procedure

With EMPHASIS switch OFF

- (1) Turn OFF the emphasis switch located on the toggle switch panel.
- (2) Apply a +4 dBs signal to the digital audio channels with the signal frequency set to 400 Hz, 1 kHz, and 10 kHz (0 dBs=0.775V) and measure the channel output distortion for each frequency.
Confirm: distortion<0.05%
- (3) Apply a +23.5 dBs signal to the digital audio channels with the signal frequency set to 400 Hz, 1 kHz, and 10 kHz (0 dBs=0.775V) and measure the channel output distortion for each frequency.
Confirm: distortion<0.05%

With EMPHASIS switch ON

- (1) Turn ON the emphasis switch located on the toggle switch panel.
- (2) Apply a +4 dBs signal to the digital audio channels with the signal frequency set to 400 Hz, 1 kHz, and 10 kHz (0 dBs=0.775V) and measure the channel output distortion for each frequency.
Confirm: distortion<0.05%

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